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TWENTY-FOURTH BIENNIAL REPORT

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NOV 27 1918

OF THE

STATE BOARD OF HEALTH

OF

CALIFORNIA

FOR THE

Fiscal Years from July 1, 1914, to June 30, 1916

CALIFORNIA
STATE PRINTING OFFICE
1916

REPORT

State Water Problems Conference

¶ Acting under instructions of the California Legislature to recommend "a unified state policy with reference to irrigation, reclamation, water storage, flood control, municipalities and drainage, with due regard to the needs of water power, mining and navigation."

NOVEMBER 25, 1916

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO
1916

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STATE WATER PROBLEMS CONFERENCE.

SACRAMENTO, CALIFORNIA, November 25, 1916.

Honorable HIRAM W. JOHNSON,
Governor of California.

There is transmitted to you herewith the findings, recommendations and suggestions as to legislation of the State Water Problems Conference, created by act of the legislature approved May 18, 1915, which act is as follows:

CHAPTER 359.

An act providing for the calling by the governor of a conference on irrigation, reclamation, water storage, flood control, and drainage, and making an appropriation to pay the expenses thereof.

[Approved May 18, 1915.]

The people of the State of California do enact as follows:

SECTION 1. For the purpose of considering and recommending a unified state policy with reference to irrigation, reclamation, water storage, flood control, municipalities, and drainage, with due regard to the needs of water power, mining, and navigation, the governor of the state is hereby empowered to call a conference of properly qualified persons, consisting of the lieutenant governor, who shall be chairman thereof, the speaker of the assembly and the chairman of each of the committees of the senate and assembly of the forty-first session of the state legislature on irrigation and on drainage, swamp, and overflowed lands, the state engineer, the chairman of the state water commission, the chairman of the state reclamation board, the chairman of the state conservation commission, the secretary of agriculture, and six others to be appointed by the governor. Such conference shall first meet at the call of the governor, and shall meet thereafter during the years 1915 and 1916 at such times as the chairman shall determine. Not later than November 30, 1916, the conference shall report its findings and conclusions to the governor, together with any recommendations it deems desirable to make regarding legislation; and with the filing of its report with the governor as aforesaid its existence shall cease and determine.

SEC. 2. No member of the conference provided for in this act shall receive any compensation for any work performed in connection therewith other than as already allowed by law; but each member of such conference shall be entitled to receive his actual and necessary traveling expenses incident to attendance at regularly called meetings of the conference or committees thereof; *provided*, that the traveling expenses of the members of the conference who become such members by reason of being members of a state department, board or commission shall be paid out of the funds appropriated by law for such department, board, or commission. The chairman of the conference is hereby authorized to employ such assistants as he may deem to be requisite to perform the clerical work made necessary by the proper performance of the duties of the conference.

SEC. 3. Out of any moneys in the state treasury not otherwise appropriated there is hereby appropriated the sum of twenty-five hundred dollars to be expended in accordance with law in defraying the expenses herein authorized.

CHAPTER I.

Organization and Work of Conference.

1. The State Water Problems Conference organized under this name, and in accordance with the terms of the act creating it, at the rooms of the State Railroad Commission, San Francisco, on September 18, 1915, Hon. John M. Eshleman, Lieutenant Governor, acting as chairman, as called for by the act, and W. H. Killam being appointed secretary.

2. The personnel of the conference as provided for in the act and by appointment of the Governor, was as follows:

John M. Eshleman	Lieutenant Governor
C. C. Young	Speaker of the Assembly
L. J. Maddux	Chairman, Senate Committee on Irrigation
W. F. Chandler	Chairman, Senate Committee on Drainage, Swamp and Overflowed Lands
L. L. Dennett	Chairman, Assembly Committee on Irrigation
E. L. Sisson	Chairman, Assembly Committee on Drainage, Swamp and Overflowed Lands
W. F. McClure	State Engineer
W. A. Johnstone	Chairman, State Water Commission
V. S. McClatchy	President, State Reclamation Board
J. P. Baumgartner	Chairman, State Conservation Commission
R. J. Anderson	Redding
W. P. Boone	Berkeley
Chas. L. Donohoe	Willows
L. J. Edwards	Stockton
J. B. Olcese	Merced
F. E. Woodley	Los Angeles

3. Because of ill health and absence from the state, Lieutenant Governor Eshleman attended only two preliminary meetings of the conference, V. S. McClatchy serving thereafter as chairman pro tem. The subsequent death of Mr. Eshleman deprived the conference even of his advice and counsel—a loss severely felt, for his experience in public life and with state institutions, his familiarity with physical conditions and state problems, his knowledge of the law, his balanced judgment and his untiring energy specially qualified him to direct the responsible work of the conference.

4. It was soon evident to the conference that there had been committed to it a task whose magnitude was perhaps not fully realized by the legislature, for the means and facilities contemplated by the act were entirely inadequate to proper performance of the task. Consideration of the report will furnish ample confirmation of this statement.

5. The act directs that the conference recommend a unified policy with reference to irrigation, reclamation, water storage, flood control, municipalities and drainage, with due regard to the needs of water power, mining and navigation.

6. A preliminary survey of the field disclosed the fact that the water problems of California, concerning which the conference is asked to formulate a unified policy, are greater in number and greater in magnitude than are found in any other state in the Union; that they are in many cases entirely unsolved, and their solution complicated by the absence of a state policy and the growth in consequence of independent rights and antagonistic interests under haphazard legislation.

7. Under the terms of the act ten of the sixteen contemplated as members of the conference are ex officio state officers and the remaining six are citizens in private life appointed by the Governor; no compensation is allowed any member for services; of those who have been active in the work of the conference only one receives a salary from the state; the various members—all busy men of affairs—reside in various portions of the state from Redding to Los Angeles, necessitating loss of time in attending meetings at San Francisco; and the appropriation provided in the act, $2,500, would defray traveling and other expenses for only a limited number of meetings.

8. Under the circumstances, and with full realization of the gravity of the duty imposed upon it, the conference endeavored to so organize and adjust its work as to secure results, which, while by no means complete, are, it believes, of real value as a basis for the unified policy which is the aim of the act. This could only be done by personal sacrifices on the part of members, an earnest spirit of coöperation, and an endeavor to consider all problems from the state's point of view. In securing such results as are shown in this report, the conference has been materially assisted by aid received from the state administration in supplementing its appropriation; by work of the Legislative Counsel Bureau in preparation of the necessary bills for consideration of the legislature; and by information freely extended by public officials, by public service corporations, by members of the engineering profession and by private citizens.

9. The plan followed by the conference in its work has been as follows:

(*a*) In order to secure as much reliable data and as many viewpoints on the various problems under consideration as possible, public hearings were held at which representatives of all interests, public or private, concerned in the ownership, use and control of water, were invited to be present and offer their views as to the proper state policy and legislation in connection therewith. In addition, experts in various lines were asked to read papers before the conference on subjects of which they had most knowledge. Open discussion followed.

(*b*) The twelve members of the conference who were able to be active in the work were divided into five subcommittees, and to each was assigned a list of topics which were to be investigated by it and reported on. The papers read before the conference and the data received by it were apportioned among these committees according to the subjects of which they treated, to be digested and utilized according to value, in the subcommittee reports.

(*c*) These subcommittee reports were considered by the full conference, until an agreement could be reached as to principles which the conference was prepared to adopt and policies which it would recommend. In some cases further investigation of a particular topic by the original committee, or by a special committee, was ordered.

(*d*) With the main facts before it and an agreement on policies reached, the conference named a legislative committee of five and placed in its hands the formulation of the report.

(*e*) Under direction of the legislative committee the various chapters of the report were prepared by the chairman pro tem. of the conference, or by the chairman of the committee, transmitted to members of the committee by mail, and afterwards modified and amended in meeting of the committee.

(*f*) The chapters of the report, in the form approved by the legislative committee, were mailed to members of the conference, and, at meetings of the conference, further discussed and amended, and finally approved and adopted.

(*g*) The bills for presentation to the legislature, intended to carry into effect the policies recommended by the conference, were prepared by the Legislative Counsel Bureau, under direction of the Legislative Committee.

10. Under the plan thus indicated, it has been possible to accomplish much study and work through the industry of individual members at home, and through the meetings of the various subcommittees. In no other way could a report of any value have been offered at this time, with the limited appropriation provided by the act.

11. The conference itself has held meetings of one or two-day sessions as follows: September 18, 1915; October 27, 28; November 29, 30; January 21, 22, 1916; March 23, 24; May 11; May 31, June 1; July 28, 29; November 3; November 15, 16. The transcript of minutes of these meetings is submitted with this report, as are also copies of all papers offered to the conference and various documents considered by the subcommittees.

12. The five subcommittees into whose hands was committed the task of sifting the data collected by the conference and reporting digested

statements thereof and suggestions as to conclusions warranted thereby, and the topics originally assigned to each are as follows:

Riparian rights. L. L. Dennett, Modesto, Chairman; L. J. Edwards, Stockton, Secretary; W. P. Boone, Berkeley.

Topics: Present attitude State Supreme Court.
Force and validity ten-year clause Water Commission Act.
Hawson bill which failed at last session.
Can individual riparian rights be definitely determined and reserved and balance of rights on stream opened to beneficial use?
Would riparian owners in general favor or oppose such policy if feasible?
Should the burden of proof as to beneficial use be placed upon the appropriator or upon the riparian owner?
Is it feasible to condemn for general use riparian rights not beneficially used?
In what way can the obstacles offered by present riparian rights to development be overcome?

Irrigation committee. W. P. Boone, Berkeley, Chairman; Roscoe J. Anderson, Redding, Secretary; L. L. Dennett, Modesto.

Topics: Standardization of irrigation districts and district laws.
Duty and use of water.
How may waste and injury therefrom be prevented?
Should water be sold by acre feet instead of second feet?
Should there be state control of distribution through water masters or policing system?
Should districts control lateral ditches?
Secondary use of water after power plants.
Underground waters.
Act, last legislature, reserving water of streams for fish.

Flood control, reclamation and navigation. V. S. McClatchy, Sacramento, Chairman; F. E. Woodley, Los Angeles, Secretary; J. P. Baumgartner, Santa Ana.

Topics: In addition to those indicated in the title—
Conservation.
Storage.
State control of dams and reservoirs.
Extending the work of securing data as to stream flow and precipitation.

Financial problems. W. F. Chandler, Fresno, Chairman; J. B. Olcese, Merced, Secretary; Charles L. Donohoe, Willows.

Topics: Shall the state assist reclamation and irrigation districts by issuing bonds, or guaranteeing district bonds, or by other methods?
Or should the state simply collect interest and principal of district bonds as taxes are collected (Eell's plan)?
Under any form of assistance given by state, how far should there be state supervision and control of districts?

The administrative body. Charles L. Donohoe, Willows, Chairman; W. A. Johnstone, San Francisco, Secretary; and E. L. Sisson, Red Bluff.

Topics: Shall administration of state laws as to uses of water be placed in hands of one commission, or board, or of several?
Should some existing body be utilized with extended powers and jurisdiction, or a new one established?
State ownership or control of natural resources.
Municipalities.
Mining.
Power companies.

The reports of these subcommittees will be found among the documents submitted with this report.

13. The Legislative Committee, under whose direction the report was formulated, consists of L. L. Dennett, Chairman; W. P. Boone, C. L. Donohoe, E. L. Sisson and F. E. Woodley.

14. The original appropriation of $2,500 proving inadequate for meeting the expenses of meetings of the conference and preparation and printing of the report, an emergency appropriation of $1,500 was created on April 4, 1916, by joint resolution of the Board of Control and Controller. Of the total available fund of $4,000, there has been expended in cash and incurred for services for which payment has not yet been made, a total of $3,846.57, as shown in the statement following:

Expense Account—Water Problems Conference.

Original appropriation			$2,500 00
Emergency appropriation			1,500 00
			$4,000 00
Expenditures (to November 15, 1916):			
Secretary's salary 14½ months (total)	$720 00		
Transcribing proceedings	66 80		
Copies irrigation law	7 50		
Stamps, telephone, telegraph, express, printing, stenography, supplies	167 75		
Traveling expenses members to meetings—except November 15th	1,416 30		
A. L. Cowell—drafting irrigation law	250 00		
		$2,628 35	
Estimate for additional expenses incurred:			
Traveling expenses members—meeting November 15th	$175 00		
Mimeographing, supplies, postage, etc., several issues of chapters to members for criticism	296 55		
Expenses Legislative Bureau	171 67		
Printing report, distributing, mailing, etc.	370 00		
Mimeographing bills for legislature	160 00		
Incidentals	45 00		
		1,218 22	
			3,846 57
Balance appropriation unexpended			$153 43

CHAPTER II.

Findings and Recommendations of Conference.

15. The conference was instructed by the act which created it to consider and recommend a unified state policy with reference to the control and uses of water, and report its findings and conclusions, with recommendations regarding legislation.

16. Obviously the conference could not make recommendations as to policy and legislation without study and a fairly comprehensive idea of the subjects referred to it. The preliminary studies made quite evident the following facts:

> (*a*) That the state of California possesses in a remarkable degree, water resources which can be made a source of great wealth to the state, adding to her products, commerce and population, and materially augmenting the prosperity and happiness of her people.
>
> (*b*) That these water resources are to a great extent undeveloped, and that existing conditions do not lend themselves readily to development.
>
> (*c*) That the problems involved in development of these resources are greater in number and greater in magnitude than those which confront any other state in the Union, and that they are yet, to a considerable extent, unsolved.
>
> (*d*) That these problems will remain unsolved and these resources to a great extent undeveloped until the state has established a definite policy with regard thereto and created authority with special powers to work out the problems and to direct the various matters having to do with the uses of water.
>
> (*e*) That the state is not now in position to itself develop these resources, and, if they are not to be permitted to remain indefinitely in disuse, a source of great economic waste and a bar to progress, the state should so define her policies and frame the legislation necessary to carry them into effect as to secure the largest amount of active cooperation on the part of private capital and interested landowners, under conditions which will properly safeguard state interest.

17. Foremost among the problems faced by the conference is the doctrine of riparian rights which has been given the sanction in this state of court-made law and which retards progress toward fullest utilization of the water resources of the state for all or any of the most valuable purposes; and following that, each important in its way, are the many diverse and sometimes conflicting interests having to do with the ownership, use and control of water, and the fact that California, with regard to most of the problems involved, has adopted neither a policy, nor principles upon which a policy might be based.

Navigation and irrigation are in conflict, the situation growing rapidly more acute, with the federal government ranged theoretically on the side of navigation, but winking with tolerant eye at the superior rights of irrigation; conservation stares aghast at the economic waste involved in permitting floods to run unused to the sea when it assumes they could be put to beneficial use; reclamation finds itself facing steadily-rising floods, the danger from which is augmented by the protective barriers constructed under state law for district defense; flood problems and the menace they offer can not be solved in some instances without interstate and international adjustment, and in others without a state policy and authority to insure cooperation of independent interests; the state's wonderful wealth of hydroelectric energy can not be properly developed in the absence of state action and adjustment of restrictive federal regulations; storage, flood control, irrigation, reclamation and navigation—each one a valuable factor in the development of the state—are prevented playing their proper parts in that development by lack of proper state recognition and aid; these and other great activities are more or less suspicious of each other in the belief that their interests are antagonistic, whereas, under a wise state policy, their interests could be so correlated and their work so governed that they would march hand in hand together, with benefit to each, and with greater benefit to the state at large.

18. The attention of the conference has been called by E. G. Hopson of the United States Reclamation Service to the fact that the absence of a definite policy on the part of California in such matters is delaying or preventing the accomplishment of results in the Iron Canyon and other projects. With regard to the project named, for instance, there were suggested in the Hopson report, 1915, ten alternative plans, some providing only for irrigation, some for irrigation and flood control, some for irrigation, flood control and power, and all affecting navigation more or less. Until the state has outlined a policy with regard to these various interests it is not possible to determine which of these alternative plans will best fit in with future conditions, nor to arrange with such interests as to a fair apportionment of the expense to each. This furnishes a concrete instance of the detrimental effects of the state's present attitude.

19. It was evident to the conference that unified policy as to these many diverse interests could not be recommended without a careful examination of the interests and their correlation, and an understanding of the many problems which they present. In the course of such examination as the time and facilities of the conference permitted, it became apparent that, as many of the problems had not been worked out, and as the state had not yet, in instances, determined the fundamental principles upon which they should be worked out, the

complete unification of water policies within the apparent intent of the act is not now practicable. The conference therefore devoted its time and attention to a study of the various problems presented with the idea of formulating a plan and making recommendations which might lead to future unification. In pursuance of this policy it has been able to offer suggestions which will assist in harmonizing the various antagonistic interests concerned in the uses of water by definitely defining their respective rights; to outline an organization which will enforce state policies as adopted; and to recommend fundamental principles upon which a unified state policy can be built as the organization develops and the individual problems are gradually worked to solution.

20. A perfect organization can not be built in a year, nor by one legislature. To attempt too much is frequently to lose all. The conference has been guided in its recommendations therefore by the thought that it is building, not for this year nor for the next ten years, but so far as conditions can be forecast, for the next fifty years. It has not hesitated to be apparently radical in its enunciation of a principle, the truth of which was apparently established by its investigation; but it has deemed it unwise, in the suggesting of machinery for carrying its recommendations into effect, to make such radical changes as would entirely lose the value of the existing organization before it could be replaced by another fully competent to perform the many onerous duties called for by the outlined plan.

21. Many of the findings and recommendations of this report, as epitomized in this chapter, may not meet at first with ready approval on the part of those who are interested in conservation and the intelligent development of the state's natural resources. To such the suggestion is offered that they withhold judgment until they have read with open mind, and carefully considered, the full report. The members of the conference represent many fields of activity with varied experience and different shades of thought. There were very material differences of view among them as to the principal subjects of this report when the conference was organized. There is perhaps no single member whose original views on some of these subjects have not been modified, or entirely altered, by his studies in connection with the work of the conference. Preconceived notions and well defined judgments have been in instances reversed by investigation of the facts with opportunity for hearing various interests, often conflicting, and by consideration of the state's necessities in connection with the problems considered. And yet these men of many minds close a year's investigation by uniting in the conclusions of this report.

22. The experience of the conference in this regard has convinced it that the presentation of its findings and recommendations would have little weight with intelligent legislators who are called upon to consider radical changes in state policy and state law, unless these recommendations are accompanied by a clear statement in digested form of the facts and conditions and authorities upon which the findings and recommendations are based.

23. The report, therefore, has been prepared in this form, with the general findings and recommendations briefed in this chapter; with a statement in the succeeding chapters, at the sections indicated, of the elements of each problem, and the reasons upon which the judgment of the conference is based; and with index and reference to various portions of the report and to cited authorities so that any desired detail may be obtained. Thus each student of conservation and of state policy in connection therewith, may readily pursue his own investigation and determine to his satisfaction whether the conclusions of the conference are justified or not. In accordance also with the suggestion of the act the conference has had prepared by the State Legislative Counsel Bureau proposed bills intended to carry out the intent of recommendations herein made, for consideration of the legislature. A list of these bills appears in Appendix "B."

The findings and recommendations of the conference may be thus briefly epitomized:

24. *To encourage private development of natural resources.* The people have not approved, nor does our form of government readily lend itself to the rapid and efficient development and management by state authority of such great and varied water resources as are present in this state. The fundamental policy of the state then should be to adopt such principles and enact such legislation as will secure early and complete conservation and use of the water resources of the state by private interests and public service corporations under such careful restrictions as will fully safeguard state and private rights and permit the state at any time and for a fair consideration, to assume complete control and ownership.

25. *State water boards.* Theoretically the conference favors the idea of placing all matters having to do with the ownership, control and use of water in this state under one commission. It is satisfied, however, that in practice such a plan should not be attempted until the great water problems of the state have been solved in policy and plan, and the duties to be performed in connection therewith have been reduced largely to administrative ones. It recommends, therefore, that state authority in water matters be vested in three state commissions, with

jurisdiction so regulated as not to clash, and with wide powers similar to those enjoyed by the State Railroad Commission.

26. For the three commissions there are recommended a State Flood Control Board having jurisdiction over all matters of flood control, reclamation and drainage, and taking over the duties of the present State Reclamation Board; the present State Irrigation Board, with authority over general matters having to do with irrigation; and the present State Water Commission, with authority over water matters not included in the jurisdiction of the other boards. Careful consideration of the water problems of the state, as explained in this report, will indicate that the satisfactory solution of these problems will call for several years' work of three boards, even if composed of the ablest men to be found in the state. (Secs. 50–63.)

27. *Water legislation.* Inasmuch as hasty and ill-considered legislation is likely to present more or less obstacles to any attempt to unify state policy as to water matters, it is recommended, for better information of the legislature, that copies of all bills introduced before that body and having to do with the use or control of waters, or matters connected therewith, shall be at once referred to the three state water commissions, and that they be required, according to their respective jurisdictions, to report back to the legislature, on or before the opening day after the February recess, such facts and recommendations as they deem of value in connection therewith. (Sec. 56.)

28. *To lessen the riparian right evil.* Recognition by the state, through her courts, of the common law doctrine of riparian rights, furnishes the greatest present obstacle to speedy and efficient development of the great water resources of the state. It is too late now to abrogate that law, as was wisely done in a number of western states whose conditions are similar to those of California; and it is at best doubtful if the riparian right can be legally limited to cover only such water as is actually put to beneficial use by the riparian owner. While the state may not take away the riparian right, which under California court decisions has become a property right, it may modify or control the remedies applicable to the protection of that right. The conference recommends, therefore, as measures likely to minimize the existing evil:

(*a*) A law empowering the court to determine the amount of damage sustained by a complaining riparian owner and the conditions under which the proposed interference with his riparian right may continue.

(*b*) A law prohibiting the issue of an injunction on application of a riparian owner unless damage is shown.

(*c*) A law limiting the time within which a riparian owner may bring action to protect his rights to three months after notice of the work of which he complains. (Secs. 152–172.)

29. *Economic waste of water power.* It is pointed out that California is allowing to go to waste an amount of available hydroelectric power which if produced by coal would cost annually $168,000,000; that while it is claimed the local market for current for ordinary uses of light and power is less than the capacity of installed plants, it is not improbable that improved methods of service and of marketing the current would induce increased consumption; that at all events there are other and greater uses for hydroelectric power not yet projected in this state and which would in no way compete with the business of established companies; that first among these uses is the fixation of nitrogen and the manufacture therewith of fertilizers and explosives (vitally necessary to the life of every nation in peace and in war), for which the state is now sending abroad many millions of dollars, and the market for which outside the state is practically unlimited; that among other uses are the smelting of iron and steel in the electric furnace and the manufacture of many electro-chemical products; and that it is declared a commercial revolution is dawning in the world which will place the centers of industrial progress not necessarily where available supplies of coal and iron are found, but where there are great sources of hydroelectric power.

30. It is recommended, therefore, that this subject receive at once careful investigation on the part of the proper authorities to determine to what extent and how this available power can be profitably utilized; that state policies in these matters be determined; that efforts be made to secure such modification of prohibitive or restrictive federal legislation as will encourage embarking of private capital in power plants while properly safeguarding public interest; and that the state, by encouragement and aid, foster such enterprises, but always with such restrictions, as, while insuring protection and fair profit to investors, shall leave proper control and right to purchase the plants at a fair price, in the hands of the state. (Secs. 64–118.)

31. *Superior rights of irrigation.* Irrigation is recognized as a superior beneficial use of water to navigation. It is recommended that if in the future it shall appear necessary to take out of a navigable stream for irrigation so much of its flow as to endanger navigation, then if such navigation be necessary in the state's interest for insuring profitable markets for the products of irrigation, navigation shall be maintained by canalization (Secs. 239–257). Mining, too, is recognized as an inferior right which will have to yield to irrigation when the two conflict (Sec. 305).

32. *Improvement of inland waterways.* Attention is called to the advantages enjoyed by certain sections of the state in transportation

rates because of inland waterway facilities; to the important part played by such waterways in this country and more particularly in Europe in the development of districts and communities; to the valuable nucleus which the state has for an inland waterway system in the Sacramento and San Joaquin rivers, and the San Francisco Bay with its various branches, which must serve as the main arteries of any such system; to the possibilities of extension of this system, through canalization, so as to cover practically the greater portions of the Sacramento and San Joaquin valleys; to the fact that water communication of this character would insure intensive cultivation of the entire floor of the two great valleys, since the products, with cheap water transportation, could find access to world markets at more profitable prices, and that thereby the commerce, wealth and population of the state would be greatly increased (Secs. 221–238 and 333–361).

33. In the absence of definite data as to the expense involved in gradual extension of such an inland waterway system the conference can not express a judgment as to its economic value. It recommends, however, that the facts covered in the Appendix "A" to this report, "The Economic Value of Inland Waterways to California," be considered as foundation for an exhaustive inquiry into the subject, and that necessary surveys and estimates be made to determine the feasibility and cost of canalization of the two great valleys. Following the ascertainment of the facts, it recommends that the state determine a definite policy as to inland navigation, and, if it be practicable, establish and maintain general open water highways over which her citizens may freely ply water craft for business or pleasure. Such a policy is now pursued by the state with excellent results in connection with her land highways.

34. *State control of reclamation.* In connection with reclamation, it is recommended that a policy be followed throughout the state similar in principle to that now enforced under the Reclamation Board Act throughout the Sacramento and San Joaquin Drainage District; that is, the establishment of comprehensive plans for flood control and reclamation suited to the conditions which obtain in the respective sections, and the enforcement by state authority of compliance with such plans by individuals and districts. It is contemplated, while general control shall be exercised by the state authority, actual construction, so far as practicable, and administration of internal affairs shall be done by the various districts under general state laws insuring efficient administration, but that the state board may on request, or shall, in case of necessity, if districts or individuals refuse or fail to carry out an adopted plan, undertake construction of works itself. Only by some plan of this character can safety be assured to all resi-

dents in a flood control district, since each holding is dependent not only on its own defensive works but also on those of its neighbors. (Secs. 57–60 and 201–216.)

35. *State aid for conservation.* It is recommended that a general plan of state aid be inaugurated for storage, irrigation, reclamation, and similar enterprises which serve to conserve and devote to beneficial use great natural resources, and which add thereby to the wealth and development of the commonwealth. The recommendation looks to the use of the state's credit therefor, and the issue of underlying state bonds under authority of a proposed constitutional amendment. The condition is made, however, that necessary restrictions shall be imposed to insure the return to the state of moneys thus obtained, and to insure protection to public and projects by state approval of plans and supervision of construction and operation. Assessments for payment of district bonds and interest are to be collected by county tax collectors and the land sold for nonpayment of assessment, as is done in the case of delinquent taxes. In this way, it is believed, the state can remedy without loss to herself, the present unsatisfactory condition which forces irrigation and reclamation districts at times to market their bonds for 15 to 30 per cent discount, and, in effect, to pay that much more than the market price for labor and material. (Secs. 318–330.)

36. *Temporary state aid.* Pending passage of a constitutional amendment sanctioning state aid and loan of credit to approved irrigation, flood control, reclamation and water power enterprises, it is recommended for temporary relief that a revolving fund of $500,000 be created by the state out of which shall be paid on demand any coupon of such an enterprise, payment of which had been refused by the proper authorities thereof. This payment, however, would be made only for coupons of enterprises whose bonds had been approved by the proper state commission, and which had agreed to accept certain conditions of the law, principal of which is that which declares that when payments thus made on behalf of any such enterprise amount to 15 per cent of the current interest due by it for one year, the state may take charge of administration of such enterprise and retain it until payment of the amount of coupons redeemed. (Secs. 331, 332.)

37. *Underground waters.* In order that the beneficial use of underground waters may not be hampered by the gradual recognition in this state of the doctrine of riparian right in connection therewith, it is recommended that the state definitely define the rights of users of underground waters. The conference recommends in connection therewith the recognition of the doctrine of prior appropriation, so that

he who first makes beneficial use of the water shall have the right to so much as is necessary for the purpose to which it is applied. Appropriation of underground waters, it believes, should be placed under control of the State Water Commission, but the owner of 160 acres, or less, should be permitted, without application, to develop water underneath such land for use thereon. (Secs. 193–200.)

38. *Utilizing storage for flood control.* It is recognized that because of physical conditions storage for care of flood waters can not be universally applied in California, but it is urged that it can be more generally applied than is now being done. It is recommended in the interest of conservation that wherever practical flood waters be cared for by storage, and that cooperation among various interests concerned be encouraged so as to make storage projects practical which are not economically justified for one interest alone. (Secs. 258–283.)

39. *State control of dams.* In view of the great loss of life and property, which may result from the breaking of the dams of storage reservoirs and precipitation of the stored waters upon the valleys below, it is recommended that the state exercise full control over the planning, construction, maintenance and operation of such structures, with full power to prevent their use unless declared safe by competent authority; and that any violation of the law or of the order of the established authority, in connection therewith on the part of owners, contractors or operators, shall be punished not by fine but by imprisonment. (Secs. 112–117.)

40. *Reclamation assessments.* For financing the reclamation portion of the Sacramento River flood control project and other reclamation projects it is recommended that the assessment, which must be based on benefits received by separate tracts of land, be not levied and spread until after the project be completed; that the benefits be then determined by the difference between the county assessed valuation of the land before reclamation and after reclamation, with certain allowances for increment of value due to other causes, and provision for equalizing the assessments of derelict county assessors; that the cost of reclamation, together with interest on the bonds, be paid out of funds secured from sale of underlying state bonds issued in accordance with the proposed plan of general state aid. (Secs. 217–219.)

41. *Surveys of storage sites.* As storage of flood waters is so important in the interest of flood control, irrigation, water power development, reclamation and navigation, it is recommended that comprehensive surveys be made of the available storage reservoirs and reservoir sites in the state, with estimates of the cost of necessary

works for utilization of the storage for various purposes, and information as to the territory and interests which could be benefited thereby. (Sec. 110.) And since the flood problems of the state can not be studied and properly solved in the absence of exact data indicating the flood flow which may be anticipated in the various drainage areas, it is recommended that the state secure as soon as possible complete data of this nature. (Sec. 151.)

42. *Expense in water litigation.* To reduce materially the great expense and delay involved in water litigation it is recommended:

> (*a*) That the findings of the three state water commissions be final as to all matters of fact;
>
> (*b*) That expert witnesses be no longer allowed to testify as such in behalf of either side; that a court expert be appointed when necessary, by agreement between the parties to the suit, or, if they can not agree, then by the court; and that each side may cross examine the expert as to matters concerning which he testifies;
>
> (*c*) That a superior judge be selected by the Governor to try all water cases, in accordance with the principle already established in connection with trial of reclamation cases. Such a plan would greatly reduce the number and expense of Superior Court trials as necessitated by the present system, and would tend to free them from local influence and prejudice;
>
> (*d*) That procedure in the exercise of the right of eminent domain by a state agency be so changed as to avoid delays dangerous to public interest and safety which are possible under existing methods. It is proposed to adopt the plan successfully followed in Mississippi and Arkansas, under which possession of the property is secured at once by payment of its valuation as fixed by the court. Subsequent proceedings are had to determine finally the value, and the necessary adjustment is made by payment of more money, or by return of a portion already paid, as the case may be. (Secs. 311–317.)

43. *Water for municipalities.* The conference believes unwise the doctrine of "progressive development" under which a municipality is permitted to tie up indefinitely unlimited quantities of water to meet anticipated needs of a remote future. It recommends instead that the State Water Commission be given necessary discretion to make reasonable provision for future development of municipalities. (Secs. 307–310.)

44. *Use of interstate waters.* It is recommended that the state abandon its present policy which declares that the water flowing from California into another state in natural channels is subject to use in California, regardless of rights claimed thereto under the laws of the adjacent state; and which declares also that water may not be diverted through artificial channels from California for use in another state.

It is recommended that there be substituted for such policy that now followed by the state of Oregon which authorizes refusal of permit to divert Oregon waters into another state for use, unless that other state permits similar diversion of its own waters into Oregon. (Secs. 284–296.)

45. *Congressional aid for flood control.* Attention is directed to the fact that congress, in the flood control bill which has already passed the house and is now before the senate for consideration at the short session, has outlined an entirely new policy under which it is proposed to accord to deserving flood control projects that congressional aid which has been in the past theoretically limited to projects in the interest of commerce and navigation. Should the bill pass in its present shape its provisions will be applicable to other flood control projects of the state, as well as to the Sacramento River project, which chances to be the only project of the kind west of the Mississippi now ready for approval. (Secs. 145–147.)

46. *Relation between navigation and irrigation.* It is recommended that adjustment be had with the federal government as to the apparent conflict between the duty of the War Department in preventing injury to navigation and the conceded superior rights in this state of irrigation over navigation. (Secs. 256, 257.)

47. *Adjustment of interests in Colorado River.* It is recommended that adjustment be secured if possible between the several states having interests in the waters of the Colorado River, and between the United States and Mexico, bound by treaty stipulations in regard thereto, in order that the serious flood problems of that river, so menacing to California lands, may be permanently solved, and in order that its waste waters may be conserved for use on California lands which have no other available sources of supply for irrigation. (Secs. 120–128 and 279–281.)

48. *Contest as to control of Lake Tahoe.* It is recommended that the state right as to control of its share of the waters of Lake Tahoe, now a matter of issue between the state and the United States Reclamation Service and the Interior Department, be determined as soon as possible, and that a state policy be established with regard to such waters which, while protecting the lake's scenic beauties and state and private rights, shall allow such beneficial use of lake waters as is practicable. (Secs. 286–290.)

49. *Water for fish life.* It is recommended that the provision in the act of 1915, amending Sec. 637 of the Penal Code and forbidding the holding back or use of stream water needed for fish life below, be repealed. Such provision would prevent a higher beneficial use of the water. (Sec. 118.)

CHAPTER III.

Consolidation of Commissions.

50. In considering a unified policy for the state as to all matters connected with the control, ownership and use of water, it was quite natural for the conference to make careful investigation and give consideration to the feasibility of placing all such matters under control of one board, or commission, and giving it jurisdiction and power sufficient to accomplish necessary results. Such a plan has much to commend it, and was urged before the conference in an able paper by C. E. Grunsky, as desirable, not only for matters connected with water, but for other matters now handled by various boards and commissions, or departments. His suggestion looked to a board of public works, which would take over the powers and duties of the Engineering Department, the Highway Commission, the Reclamation Board, the Water Commission, the Irrigation Board, the Conservation Commission and perhaps others, giving it powers similar to those of the State Railroad Commission, and an organization which could adapt itself readily, by departments under expert heads, to a proper management of the various important matters with which it would have to deal.

51. The members of the conference favor the general theory indicated, and many were of the impression at first that it could be made of present practical application to the needs of California. The subcommittee on administration, to which was referred this subject (Sec. 12), made careful investigation, and, following its report, the conference had a number of discussions. The conclusion was finally reached that even as to water matters a general consolidation of commissions would be unwise at this time, though it is believed such a plan could be followed in the future to advantage. The difficulty lies in the multiplicity of the water problems of the state, the important character of most of them, and the fact that they are to a great extent unsolved, or only partially solved problems. It is believed, therefore, that each group of problems can be best developed and worked out by trained specialists and administrators devoting their entire time and attention thereto; and that consolidation under one general commission, or board, should not be attempted until such time as the various problems have been satisfactorily solved, and there remains only the purely executive work along well established lines or principles, which can be turned over to a single commission, whether called by the name of board of public works, or otherwise.

52. The conference is aware that other states have consolidated the duties now performed by various commissions in California under one

board; but it has also found that in none of these states have there been so many or so great problems, nor were they in the important development stage as in California. It has also evidence that to burden one board, or commission, with a multiplicity of powers and duties, connected with widely diverse interests requiring special knowledge and training, not infrequently results in grave neglect of all interests, or of all but one or two. A private organization, under able excutive management and with capital, can readily adjust itself to new demands of this character; it is much more difficult to do so in a state commission with the restrictions in personnel dictated by politics, and the restrictions in policy and action due to legislative enactment and appropriation, or the lack thereof.

53. For the reasons indicated the conference advises against the consolidation at this time of the State Reclamation Board, the State Water Commission, and the State Irrigation Board. It believes that the efficiency of these three commissions can be very materially increased along lines suggested, and that by following such a policy, the state will not only receive immediate and steadily increasing benefit, but that as the many problems of these commissions are thus solved and a definite state policy in regard thereto established and projects adopted, the time may come when the administrative work of carrying out the policy and completing the projects can safely and advantageously be left to a consolidated commission. In that event it might be well to so organize such consolidated commission that it shall be composed of not more than five members, each devoting himself to certain specialties and acting as head of a department, and carrying out in such department the policy approved by the commission as a body. The conference believes that better results can be secured by having such a commission composed, not of specialists or engineers, but of men of proven executive and administrative capacity, with authority to employ any necessary engineering and other talent.

54. In order that the three commissions named may prove efficient and possibly pave the way for a consolidation, as suggested, the conference recommends that each be given power and authority in its respective field similar to that possessed by the State Railroad Commission, and that its findings as to facts, in all matters within its jurisdiction, be final, so that the courts need pass only on law points. If the latter recommendation be carried out there can be effected a great saving in time, money and energy, now unnecessarily expended in vexatious litigation. Jurisdiction over all the water problems of the state should be so distributed among these three commissions that each problem may be effectively handled without clash of authority. That

this is entirely practical is demonstrated by the experience of the present Reclamation Board and the Water Commission.

55. Under the plan proposed each of the three commissions should be composed of men of proven balance and ability, giving their entire time to the duties of the office and receiving compensation sufficiently large to justify their abandonment of private business. The positions should be removed entirely from political influence, and local prejudice, and the commissioners should be capable administrators rather than expert specialists. It is recommended that the Governor have power, in his discretion, to appoint the same person as member of any two of these commissions with the proviso that such appointee shall receive only one salary. This power, wisely exercised, may lead in time to a practical consolidation of commissions, if such policy shall appear feasible and wise.

56. That the legislature may act on all bills having to do with water, with full knowledge of all the facts, and thus materially aid in the unification of policies which is the object of this report, it is recommended that copies of all such bills introduced at the first month's session of the legislature be promptly referred to the three state water commissions with instructions to report back in accordance with their respective jurisdictions, on or before the first day following the legislative recess, such facts and recommendations in connection with such bills as may be of value.

State Flood Control Board.

57. In pursuance of the policy thus indicated, the conference recommends radical reorganization of the State Reclamation Board. That board is now composed of seven members serving without salary. They are allowed per diem for a limited number of meetings per year, but are necessarily devoting to state work a great deal of time for which they receive no compensation. The system is bad, and must result in grave injustice to the individual officials or in neglect, more or less serious, of the state's interest. The board should be composed, say, of three members, devoting all their time to the duties of the office and receiving a salary commensurate with the importance of those duties.

58. The jurisdiction of the Reclamation Board under the present Reclamation Board Act is confined to care of the great flood control project of the Sacramento River and matters connected therewith. This project is a state project by formal adoption and because it is essential to inland navigation and protection against flood, and a necessary factor in the reclamation of rich lands in the two great valleys of the state, while the development of the wealth, population, and commerce of the state depend partly upon it. The powers of the board are only locally applied, however, because confined to fourteen

counties of the Sacramento and San Joaquin valleys, and for certain purposes, on tributaries of the Sacramento and San Joaquin rivers outside such counties.

59. The conference recommends that the jurisdiction of the Reclamation Board, reorganized, as suggested, and under the name of "State Flood Control Board," be extended over the entire state, and that it be given sole and very full powers in all matters of flood control, reclamation, as connected with flood control, and drainage, with supervision of dams, etc. It believes that the initiative in flood control projects should come from local interests, that the plans therefor should be submitted to and approved by the Flood Control Board and that the actual construction, so far as possible, should be done by the local organizations or districts, subject to supervision of the board's engineer; and that the districts should be independent in management of their internal affairs under laws providing for efficient administration thereof. The board should be empowered to take active direction of construction in a particular district or project when requested so to do. It should retain permanently the administrative direction of the Sacramento and San Joaquin Drainage District and of the Sacramento River flood control project, as contemplated by the present act.

60. In view of certain complications which exist as to control and use of interstate waters in which California is interested, as explained in Chapter XIII of this report, on "Interstate Waters," the Flood Control Board should have authority to confer with the authorities of other states and of the United States and thus aid, so far as practicable, in securing an early adjustment of these complications.

State Irrigation Board.

61. The present Irrigation Board seems to have been established, as was the Reclamation Board originally in 1911, as an experiment, its members receiving no salary and no adequate allowance for expenses. The valuable work which this commission can accomplish with proper authority and resources, is already apparent. Its members should be properly salaried, clothed with necessary authority, and given an appropriation which will make the commission of value in the unified plan herein suggested. The principles embodied in the Irrigation Board Act seem to meet general approval of irrigation interests, but practice under it will undoubtedly suggest details in which the act can be improved, as was the case with the Reclamation Board Act. The conference recommends that such control over irrigation districts or other public irrigation enterprises as shall be assumed by the state shall be administered through the Irrigation Board under the same general policy as recommended for supervision of reclamation districts by the

State Flood Control Board. It is recommended that plans for irrigation districts be subject to approval by the State Irrigation Board instead of by the State Engineering Department as at present, but that any necessary engineering investigation and report needed by the board be secured by it from the State Engineering Department. It is recommended that the Carey Act Commission, created ex officio by the act of 1915, be abolished and its powers and duties imposed on the State Irrigation Board.

State Water Commission.

62. The present State Water Commission was established, too, without full realization on the part of the legislature of the magnitude of the problems involved. The commission was given insufficient power to carry on the work for which it was created. The conference urges that the Water Commission be given full jurisdiction and powers over matters connected with the uses of water and not interfering with the powers already outlined for the State Reclamation Board and the State Irrigation Board. Included among such powers should be the right to reject an application for the use of water when in its judgment the approval thereof would be against public welfare; the exercise of such power, however, to be subject to review by the courts of the state. In determining the question of public welfare the commission may take into consideration the relative value or importance of the possible conflicting uses of such water.

63. Elsewhere in this report will be found various suggestions in connection with the conduct of these three commissions and the financing of the projects with which they would deal under the policy herein recommended, while the proposed bills submitted herewith for consideration of the legislature will indicate some of the steps thought necessary to carry the recommendations of this report into effect.

CHAPTER IV.

The Conservation and Use of Water.

64. In California rainfall is not sufficient on the average and is not so distributed through the season as to produce maximum crops. Drainage areas have not been so arranged by nature as to give most water where there is most thirsty and arable land. In the Sacramento Valley, with 4,238,000 acres of land, including foothill land, there is an average run-off of 25,910,000 acre feet—more than sufficient, if it could be conserved, for profitable irrigation of the land. In the San Joaquin Valley, with 12,238,000 acres of land, there is an average annual run-off of 12,121,000 acre feet—only one-sixth as much in proportion as is found in the Sacramento Valley and quite insufficient for irrigation of all the land under present methods. South of the Tehachapi the proportion of surface run-off to land, arable, arid and semiarid, is still smaller. In the interest of irrigation there is, therefore, every incentive for conservation of water, and particularly of that portion which under present conditions runs in waste to the sea.

65. Apparently there is not enough water to permit fullest cultivation of all the lands of the state, even if properly used. Experiments made, in the course of researches in behalf of San Francisco's water supply in 1914 and 1915, showed that as much as 80 per cent of the water used for irrigation in certain localities was lost by deep percolation, while the average loss on sandy loam and loam soil, largely through careless or faulty irrigation, was 60 per cent. It was found that where water was cheapest there was the greatest waste and least efficiency, and where it was costly, and particularly if accurately measured, there was it most economically and most efficiently used. These facts prompt the suggestion on the part of Thos. H. Means, formerly in the United States Department of Agriculture and later with the United States Reclamation Service, that the state, in addition to providing that water shall be beneficially used, should set a limit to the amount per acre which may be used. As this amount would vary with different conditions in various parts of the state, Mr. Means further suggests that authority should be placed in the proper state commission to determine the limit for each locality.

66. As to the other main purposes for which water is used—domestic supply, power and mining, it is notorious that a municipality owning its own water system and charging a flat rate will show a consumption per capita two or three times as great as one which is supplied under the meter system. In use for power there is practically no loss of the stored water, though, if it can not be used below the power plant for irrigation, it becomes at once a question which is the more valuable use. And it

may some day become a question as to whether the use of water for mining—if it can not afterwards be used for irrigation—shall not be abandoned. Such action would be in harmony with the steadily growing sentiment that irrigation is a superior use to navigation.

67. The suggestions made above have to do with the conservation of water in the use thereof. An even more important subject is the conservation by storage of the flood waters and regular flow which now run in waste to the sea, and the beneficial use thereof for one or more of the four purposes named.

68. Some of the difficulties in connection with the problem of holding back California floods in reservoirs are indicated in Chapter XII on Storage for Flood Control. But manifestly every encouragement should be offered by the state for early storing of so much of these waters as is practical. There is sufficient incentive now perhaps for such storage if designed for municipal purposes or mining. If intended for irrigation, or to aid in reclamation, its value for such purposes, together with adoption of the recommendations of this report looking to improved legislation for organization and financing of irrigation and reclamation districts, should encourage large increase in storage.

69. It is claimed that there are certain complications which militate against storing of waters for power in California, and as therein lies one of the state's greatest natural resources, that subject is taken up in more detail.

California's Unused Water Power.

70. The state engineer of Oregon reported in November, 1912, that his state was wasting annually $144,000,000 worth of "white coal" in her unused water power. That is to say if she would fully develop that great resource it could be used in the manufacture of various products and by-products and for various purposes calling for an amount of energy which, if furnished by coal, would require the expenditure of $144,000,000 annually.

71. California is even richer than Oregon in potential water power, being surpassed in that regard by only one state—Washington. On the basis of figures quoted for Oregon, California's water power resources, if fully developed, would be worth to her $168,000,000 annually. The three Pacific coast states have 42 per cent of all the available water power in the United States, which is said to be maximum 53,905,000 horsepower and minimum 27,943,000, as indicated in the report of the Commissioner of Corporations, 1912.

72. In comparison with the potential horsepower in California (stated in the report named as maximum 7,818,000 horsepower, minimum 3,424,000 horsepower), the state had on January 1, 1916, a total installed water power plant capacity of 579,421 horsepower, with subsidiary

steam standby plants of 377,145 horsepower capacity, as shown by data in the office of the district engineer of the United States Forest Service at San Francisco. There are, in addition, at the date of this report, four plants in course of construction with an aggregate capacity of 114,000 horsepower, so that the water power plants installed and in course of construction have an aggregate capacity of one-fifth of the state's minimum and one-tenth of her maximum resources in this direction.

73. In the meanwhile the state is paying an enormous amount of money annually for coal, which she must import at heavy expense; for fuel wood from her forests; for natural gas; and for oil from her oil fields, all of which are used very largely for purposes which could be accomplished with equal efficiency and greater convenience by use of hydroelectric energy. The amount of wood, gas and oil thus used is an absolute economic waste to the state, since the supply, particularly of the latter two, must under present demands, disappear entirely within a comparatively few years. The supply of "white coal" on the contrary, is inexhaustible; the entire available supply may be used this year, and next year there is as much—or even more if the floods are greater—ready for use. The state's supply of oil and gas could thus be conserved for uses for which they alone will serve.

74. The proportion which installed water power plants in the United States bear to the maximum potential power that can be developed is about the same as found in California—6,000,000 horsepower out of 54,000,000 potential. It is declared that this amount could be raised with practicable maximum storage to 200,000,000. All the countries of Europe combined have but 36,000,000 available horsepower, and they are rapidly developing this up to capacity. Germany has practically made use of all she has. Why this great difference between the two continents? And what the lesson for California?

75. Europe is economical with her resources; the United States extravagant and wasteful. The many uses to which water power and its equivalent—electric energy—can be put without diminishing the supply, and the saving which can be effected thereby in the use of other resources, as indicated above, furnish sufficient reason to any student of efficiency why Europe should act as she has done. There is, however, a greater and a more pressing reason.

Hydroelectric Nitrate Plants

76. The world's supply of nitrates which comes now from Chile will be exhausted in a comparatively few years. Nitrates are used in peace to fertilize the soil, and in war as the necessary basis for all ammunition and explosives. A country without nitrates, or without access to foreign

supply, must degenerate agriculturally in peace, and be a helpless prey for the enemy in war.

77. The average yield per acre in bushels for various crops in the United States and in Europe is given as follows:

	Wheat	Oats	Barley	Rye	Potatoes
Europe	32	47	38	30	158
United States	15	29	25	16	96

The reason? Europe uses per acre of cultivated land 200 pounds of fertilizer; the United States uses 28 pounds. Germany, in twenty years, by the use of fertilizer has increased the average yield of all crops grown by her three and one-half times as much per acre as America. The German Agricultural Department reports show that by feeding the soil with 2,000,000 tons of nitrate, there was secured an increase in crops of 63,000,000 tons. In Germany intelligent effort has been directed to replace the nitrogenous compounds extracted from the soil by crop growth; in the United States the average agriculturist has seen his land yield steadily decreasing crops without attempting adequate remedy.

78. As a measure of preparedness in event of war the United States has been attempting to accumulate a reserve stock of 32,500 tons of Chilean nitrate. Her army and navy use annually in peace 3,000 tons. The reserve stock contemplated would make enough explosives to last possibly a week in a modern war, and at the end of that time the nation would be powerless unless her navy were strong enough to enable her to commandeer a supply from Chile, against the efforts of her enemy and possibly the wishes of the world. A cheerful outlook for a nation whose foreign relations are becoming complicated!

79. There is an unlimited amount of nitrogen in the air which can be readily extracted therefrom by hydroelectric plants, and in combination with elements of rock and soil, turned into the nitrates so valuable for fertilizers and explosives. The same hydroelectric energy will extract from phosphate rock the phosphoric acid so necessary also for fertilizer, and do it at less cost than any other known process. Any country blessed with great natural water power resources can, therefore, by proper use of such resources, make herself absolutely independent as to the necessary supply of that nitrogen which has become essential to the progress and life of every nation. A horsepower and a half of hydroelectric energy will produce in a year a ton of sodium nitrate. The method of manufacturing fertilizer from the Chile deposits produces a composition of 12 per cent active fertilizer and 88 per cent useless material on which freight must be paid, while the electrofertilizer product contains 60 per cent of fertilizing material.

80. The United States is importing from Chile annually 625,000 tons of nitrate, valued before the war at $23,000,000 (including the Chilean export duty of nearly $8,000,000), but now worth $37,500,000. That entire amount of nitrate could be manufactured in California by utilizing 1,000,000 horsepower of her unused water power resources. California herself is using about 50,000 tons of Chilean nitrate annually at a cost before the war of nearly $2,000,000, increased now to $3,000,000. She should be using many times as much, and doubtless in time will be. A 75,000 horsepower hydroelectric plant would supply what she now uses, and she has enough reserve water power to supply future wants in this and other directions.

81. Germany having practically utilized her entire water power resources has established a nitrogen fixation plant in which the electricity is generated from cheap coal. Without her nitrate plants she would be powerless in the present war. The great water power of Norway and Sweden is being taken up largely by English capital for nitrate plants. Similar plants have been established in Australia, Italy, Switzerland, France, Spain, Japan and Canada. Nitrogen plants in Europe represent now an aggregate investment of $330,000,000, employ 50,000 people, and turn out annually products and derivatives valued at $220,000,000.

82. The United States as yet has no nitrogen plant, though the last army and navy bill made provision for one.

83. With California's wonderful resources in water power, with the inviting market thus indicated for nitrates, with the steadily increasing demand for electric energy for various purposes, with the opportunity to save our supply of oil for purposes other than heat and steam power, why is the development of water power in this state retarded? Obviously such development must be made either by the United States, or by the state, or by private enterprise under terms imposed by either one or both governments. It seems unwise to look to either federal or state government for immediate action in constructing plants; there is left then only the alternative of having them built by private capital. This plan can not be followed successfully unless the conditions are such as to induce capital to embark in investments of the character; and it should not be followed, in the judgment of the conference, unless public interest is properly safeguarded, meaning thereby that there should not be granted in the future, as have been granted in the past, vested rights in natural resources which preclude reasonable control by the state or the acquisition of plants for fair compensation whenever such course shall appear desirable. California is concerned, therefore, in knowing the conditions which confront her if she attempts to turn to beneficial use her great wealth of water power: first, the extent to

which government policy may aid or hinder such development; and next, the physical and commercial factors which add to or detract from its attractiveness for business investment.

Federal Control of Water Power.

84. It appears that the greater portion—perhaps nearly all—of the available water power in California is subject to control of the federal government, because in each case the canal, or the generating plant, or the transmission line must be located either entirely or partly on government-owned land, or on federal reserve land, and, therefore, subject to such restrictions and regulations as the United States, in leasing such lands for water power purposes, may impose. A large part of the mountainous portion of California is within the boundaries of the national forest, and the principal part of the unreserved public lands border on the forest. The conference has not been able to learn just what proportion of the available water power of the state is entirely free of federal control, but it is apparently a very small portion.

85. The federal government does not own the water of the streams, and, as an appropriator, can not theoretically claim or exercise rights which are denied to the private appropriator. In fact, the various water power bills now before congress recognize the superior rights of the state in such matters, and provide that the government's permit to an applicant shall be subject to the laws of the state and to such regulations and conditions as may be imposed thereunder. The federal government can not confer by permit or otherwise rights which it does not possess and which properly belong to the state. On federal lands, the government, as riparian owner, is given, under the California law, certain rights to the use of the waters of the stream, which rights can be conveyed to others under lease or otherwise. On lands which it does not own, whether in federal reserve or outside thereof, the federal government has no such rights in water, but has, in effect, frequently asserted and assumed them where it became necessary, in connection with a water power enterprise, for an applicant to secure right of way for canal or transmission line over federal reserve or government land. In such cases, under present laws, the conditions exacted are restrictive and at times prohibitive. A valuable consideration is usually asked for the lease, either in tax or otherwise, which must necessarily increase rate to the consumer; and this tax, exacted for new development in the West, is often used in the interest of conservation in the East, where lax policy has permitted practically all valuable natural resources to pass into private ownership. The result is that capital is not encouraged to aid in water power development and the state suffers loss thereby. It is understood that the departments of the Interior and of Agriculture,

which issue these government leases for water power purposes, favor material modification of the restrictions referred to.

86. The control of these natural resources thus assumed by the federal government has been the subject of adverse criticism, as well as of commendation. While the policy in effect often invades the state right, the conference is of opinion that in many states, and in California up to the passage of the present Water Commission Act, it has served to safeguard valuable natural resources, which, under usual lax state law and methods would have passed permanently into private ownership and conferred vested rights in the highest degree inimical to public interest. Where, however, the state has properly safeguarded public interest in these matters there is no good reason why she should not exercise the rights to which she is properly entitled. One excellent reason why she should then exercise such rights is found in the fact that development of such resources would progress more rapidly under wise state direction than under federal control.

87. The facts with regard to federal control of water power rights are as follows: To establish a water power plant on a navigable stream, permit must be first obtained from the War Department; for similar privilege on a nonnavigable stream on government land (whether reserved or not) permit must be had from the Secretary of the Interior, or the Secretary of Agriculture, as the case may be.

88. The existing federal law as to water power on navigable streams was passed in 1910. Under it each project must be authorized by special act of congress. In view of possible national necessity the government reserves the right to force the grantee at his own expense to remove his hydroelectric plant and restore the stream to its original condition; and also reserves the right to amend the act without liability to grantees who have installed plants.

89. The law as to use of public lands for water power purposes was passed in 1901. It authorizes the secretaries of the Interior and of Agriculture to permit such use, under general regulations to be fixed by them. Any permit so given may be revoked.

90. Bills are now before congress to change the present government policies in regard to water power installation. In regard to installation on navigable streams, the Shields Bill, passed by the senate, provides general conditions under which permits may issue, and gives the Secretary of War discretion in passing upon them. The bill contains a proviso that before the permit is issued by the Secretary of War the permittee must first obtain, in such manner as may be required, the consent of the state or states in which the dam or other structure for the development of the water power is proposed to be constructed. This

bill has been severely attacked as not sufficiently guarding public interest in many of its provisions.

91. The House Committee declined to accept the Shields Bill and substituted therefor the Adamson Bill, which places more restrictions upon the permittee and compels him also in each case to secure approval of congress, as is the present law.

92. In regard to plants on government lands on nonnavigable streams the Ferris Bill, passed by the house, is similar to the Adamson Bill in that it compels each permittee to come before congress, while the present law does not. The Senate Committee refused to accept the Ferris Bill and substituted the Myers Bill, which provides general conditions and compels the Secretary of the Interior to grant the application if the law has been complied with. Both the Ferris and the Myers bills specifically provide that nothing in the act shall be construed as affecting or interfering with the laws of any state relating to the control, appropriation, use or distribution of water.

93. The existing federal law as to water power on navigable streams, and the Shields and Adamson bills, have little practical interest for California, since the power exercised by the War Department in connection therewith has been apparently confined to plants on the navigable portions of the streams; and there is in California no available power location so situated, the navigable portions of our rivers being on the floor of the valleys. The state has, however, greatest interest in the present law of 1901, placing in the hands of the departments of the Interior and of Agriculture control of power plants, when situated on government-owned or reserve land, or when compelled to place transmission lines or canals thereon; and in the Myers and Ferris bills, which deal with this phase of the matter.

California's Water Power Laws.

94. The water laws of California, prior to 1911, were too loosely drawn and permitted the acquirement by private parties of vested rights adverse to the public interest. The present law embodied in the Water Commission Act of 1915 seeks to remedy that fault, while at the same time offering conditions sufficiently liberal to encourage investment of capital in water power enterprises. It provides that the Water Commission shall grant indeterminate licenses to applicants upon compliance with certain specific requirements; that these permits shall not be revocable save for nonuse or failure to comply with the conditions thereof; that the state shall have the right to take over the property at any time after twenty years upon payment of just compensation therefor, to be established under the law of eminent domain; and that in determining such compensation, or the value of the property as a basis for establishing

rates to be charged the public, no allowance shall be made for the water right beyond such amount as may have been paid the state therefor. The State Water Commission believes that these provisions, while fair to the permittee, substantially safeguard public interest and justify granting to private capital the opportunity of developing these water power resources. In that conclusion this conference generally concurs. It suggests, however, that the limitation of twenty years, before which time the state may not acquire the property, should be removed, since the facts contained in this chapter will readily suggest contingencies under which the possession of the property would become of vital necessity for state and nation. In fact, it may not have been the intent of the legislature to prevent the state taking the property until after twenty years, though section 20 of the act is certainly open to that construction.

95. The state law, however favorable, can not induce installation of new water plants, if, because of their location, they must be dependent on a federal permit or lease, the terms of which are unnecessarily onerous and restrictive. A minor difficulty, too, exists in the fact that in this state there is a threefold, sometimes a fourfold, control of power plants, participated in by congress, by the departments, by the State Railroad Commission and by the State Water Commission, and necessitating approval of the application by all under different regulations. It is probable that the unsettled condition of public control over public utilities has only less to do with curtailment of water power development than the actual restrictive conditions mentioned.

California Market for Hydroelectric Power.

96. Among the physical conditions and commercial considerations which influence more or less the attitude of capital towards investment in water power installation in this state, the following are noteworthy: The development of the turbine principle and the invention of the Diesel engine have so far increased the efficiency of the steam engine that it can now develop from a ton of coal, or a drum of oil, about twice as much power as it did several years ago. And a hydroelectric power plant, to compete with steam for ordinary purposes, must be able to make a favorable comparison, as to cost of installation, operation and maintenance, per horsepower, between its plant, including transmission lines, and the steam plant which can be located at the point of application of power. While this condition has undoubtedly had its effect in retarding recent power development, the steadily increasing price of oil is doing much to offset the apparent gain thus made by steam plants.

97. It is claimed that there is an overdevelopment of hydroelectric power for ordinary purposes in California, and that the real demand is for more markets rather than for more power. This is the statement made in the forest service report to the United States Senate, dated January 20, 1916, in the following language:

> There is also at the present time a considerable overdevelopment in nearly all the power centers of the Western States. California, Oregon and Washington in particular, show installation far in excess of maximum demand.

98. The statistics indicate that the use of electricity per capita in California exceeds that of any other state and that the purposes for which it is used are more varied, while the average rate charged per kilowatt hour for all purposes is less. These statistics, properly considered, however, furnish no proof either that California is using all the electric energy that she can, or that it can not be furnished her at a still lower rate. Electricity in most of the Eastern centers is produced by steam plants and is correspondingly expensive. For illumination, it is frequently a luxury as compared with gas.

99. That there is not now unsupplied market for electric energy in certain sections of the state is evidently the view of the State Railroad Commission since it has refused to permit certain new power companies to go into business because the proposed territory is already satisfactorily served by existing companies.

100. This policy of the Railroad Commission is fraught with one apparent disadvantage. Service rates are everywhere fixed by the Railroad Commission necessarily on the basis of cost of service to the company; and cost of installation and operation of plants, put in a number of years ago, involves, in instances, an amount greatly in excess of that which would cover the cost of a modern plant using the same source of supply, or a plant serving the same territory from a different source of supply. While the old plant of the established company may have been displaced in large part by a modern one, its cost is still represented by bonds and stock on which interest is allowed by the commission, and paid in rates by the consumer. Theoretically the public should have the advantage in rates justified by latest methods and improved machinery. Undoubtedly the rates are in a number of cases considerably in excess of the rates which would return fair profit on a modern plant; but, on the other hand, they may not be higher than the rates which the consumer would ultimately pay if a competing company came into the field and in time absorbed, or was absorbed by the old company. This probably is the reason for the commission's action.

101. The transmission line map of California indicates that the populated centers of the state are already well covered for light and power purposes. There is apparent evidence in this fact of a lack of market for electric energy for the ordinary purposes of light and power in the settled communities sufficient to justify immediate development of new large water power plants, though there are undoubtedly sections where there is an unsupplied demand for both light and power. But it is not improbable that, even for these purposes, and in the communities now apparently well supplied, the application of methods which increase markets in ordinary merchandising would create increased demand for electric energy. For instance, in certain districts of the state and from certain companies reasonable rates can not be had for power unless it is paid for throughout the year, whether used or not. In consequence, the farmer who needs power for a few months for irrigation, or the reclamation district that pumps drainage waters during the flood season may find it cheaper to use a gasoline engine for that short time than to pay for unused current during eight or nine months of the year. This plan of annual charge is justified by the service companies on the plea that interest on investment in transmission lines, transformers and meters can not be met otherwise. There may be found in time some practicable way of supplying the agriculturist with power and charging him only for the amount used at a fair rate. The plan that suggests itself is to find, if possible, a market for the current during the time when he can not use it.

102. Again, there is no state standard for either light or power, and it not infrequently happens in some localities that the consumer is given poor light because the company finds it economical at times to distribute among regular consumers half the current which would furnish all with a sixteen candlepower light. Light and power companies should be required by the state, to furnish for the rates charged a recognized standard in quantity and quality, as is required of the grocer and the butcher. It is not at all improbable that improvement in quality of the service rendered and a decrease in price, if justified by increased consumption, or other conditions, would lead to a very much greater use of the hydroelectric current in California, and a corresponding conservation of coal, gasoline and oil.

103. Entirely aside from the foregoing suggestions, which look to the possible enlarging of the local market for hydroelectric energy for the ordinary purposes of light and power, it appears to the conference that there are other and greater uses for such energy, which can be profitably developed to the benefit of the state and nation and without injury to the business of the existing public service companies; and

that the conditions in this regard warrant the most careful investigation by the state and the encouragement in every reasonable way of further water power installation.

104. The ordinary uses for hydroelectric energy with which California is familiar give only a meager idea of the possible economic value of the state's great water power and the part it will play in her future commercial greatness. In addition to the value of water power plants for the fixation of nitrogen and the extraction of phosphoric acid from phosphate rock and the securing thereby of an unlimited amount of basic elements needed for fertilizers and explosives, they give us now the electric furnace, which is commencing to replace coke and coal and gas and oil in the making and refining of iron and steel. The production of electric steel in this country has trebled in eighteen months and is practically as large now as that of crucible steel. The manufacture of electrochemicals is increasing by leaps and bounds. At Niagara Falls products of this character are marketed annually to the value of $18,450,000, including abrasives, electrodes, calcium carbide (used in the manufacture of acetylene gas), caustic soda, chlorates and such metals and alloys as aluminum, silicon, ferrovanadium, etc.

105. The possibilities of hydroelectric energy in these and other lines are so great that it is predicted that in the not far distant future the great industrial centers of the world will be found, not necessarily where there is coal and iron, but where there is, in addition to iron, or near enough to secure supplies thereof, the cheap electricity which can do such wonderful things in analytic and synthetic treatment of the substances of nature. These views assume a coming commercial revolution which should place the three Pacific coast states in the foreground of industrial progress if their wonderful water power resources are properly handled.

106. It is claimed that plants for the fixation of nitrogen and manufacture of electrochemical products can not be operated as economically in California as in a few other states, because of the difference in climatic and other conditions. The cheapest hydroelectric energy can be produced where there is great water power in one unit, flowing continuously through the year. The lack of rain throughout summer and fall seasons in California makes it necessary to resort to storage to operate all power plants during those seasons, and large plants can be secured not by continuous stream flow at one point, but by assembling energy accumulated at several points, or by producing it from storage water. These methods involve extra expense which, it is said,

would place this state at a disadvantage in producing nitrates in competition with a few plants in the United States until such time as the market would demand more than the entire output of such plants.

107. There is an apparent disadvantage in this situation for California which would have to be weighed in conjunction with other conditions, advantageous and otherwise. The facts quoted in this chapter, however, suggest the thought that the day may not be far distant when hydroelectric energy, for the life of the nation in peace and in war, may be worth—like water for irrigation—all it may cost. Germany, for instance, even before the present war, having utilized all her available water power, installed a plant for fixation of nitrogen, in which the electric energy was produced by steam from the burning of cheap coal. California, even if her hydroelectric power is on the average more expensive to produce than in a few large plants in the United States, would appear to have a local market for fertilizer (which she can certainly produce at less than she is now paying Chile therefor), and the possibility of market for electrochemical products.

108. Whether the conditions above outlined warrant the investment of private capital in power plants in California at this time or not, it would appear well to have such representations made to congress on behalf of California as will secure changes in the present national policy in connection with control of water power: first as to onerous and prohibitive conditions unnecessarily imposed on private capital which should be encouraged to assist, under proper safeguards, in developing these great natural resources; and second, as to conditions and restrictions amounting practically to invasion of state rights, excusable perhaps in interests of conservation where state laws are lax, but unnecessary and injurious under existing conditions in California. The Water Commission might be authorized to present this matter to congress and to the departments concerned, and secure, if possible, their endorsement for such a change of policy as is herein suggested.

109. But whether investment in hydroelectric plants can be made attractive to private capital or not, it is manifestly of advantage and even necessity to the state, both in the interest of conservation and as a means of state progress and national defense, that resources of this nature should be utilized to the fullest extent practicable, and as soon as possible.

Preliminary Promotion of Water Conservation.

110. In view of the great importance to the state of an adequate system of conservation of her water resources, and because of the absence of necessary data upon which comprehensive plans for development of such resources can be based, the conference recommends that provision be made at once for a report from the State Engineering

Department as to available sites for reservoirs for storage of flood and other waters, the extent to which the waters stored therein may be used for irrigation, power, and municipal purposes, the lands and communities which could be served thereby, and estimates as to cost of construction and maintenance of the necessary works.

111. The conference recommends also the adoption of a general state policy looking to aiding, under proper restriction, conservation projects which will have a direct bearing on the development of the commerce, wealth and population of the state, prominent among which are projects for the storage and beneficial use of water. The necessity for such aid and practical methods for extending it, some legislative and some financial, are discussed in the various chapters of this report and particularly in the following:

V. Flood Problems of California.
VI. Riparian Rights.
VII. Irrigation.
IX. Reclamation.
X. Inland Waterways.
XVII. State Aid in Interest of Conservation.

State Control of Dams.

112. The magnitude of the reservoirs necessary in instances to store the waters of California for beneficial use, creates a possible danger and suggests the propriety, in the interest of safety, of state supervision over the plans, construction, operation and maintenance of all such reservoirs and their dams.

113. The Otay disaster at San Diego is a case in point, wherein a dam, because of faulty structural plans and methods, went out with the first full head of water behind it and spread death and destruction for miles below.

114. The Big Meadows reservoir, on a fork of the Feather River, has a present capacity of 500,000 acre feet and a possibility of increasing that capacity to 1,000,000 acre feet. Even its present capacity is equal to a run of 250,000 second feet continuously for 24 hours. If then the dam should so break as to permit emptying of the reservoir in 12 hours the resultant flood would amount to 500,000 second feet; if the reservoir were emptied in six hours the flood would be 1,000,000 second feet. Such a flood would overwhelm the reclamation districts and cities along the Sacramento River. It is not intended thereby to convey the impression that the Big Meadows dam is at all unsafe, but only to point out the disaster that might result if it were not safe.

115. The Pine Flat project contemplates a reservoir of 600,000 acre feet on Kings River, and the flood of water in event of disaster would sweep down the San Joaquin Valley.

116. Dams and reservoirs of this character can be so constructed as to be entirely safe; but it would appear to be the duty of the state to make it certain that they are so constructed and so maintained as to insure safety. Otherwise, ignorance or neglect on the part of the owners, or incompetency or dishonesty in the contractors, may induce conditions which will cause destruction of property and death of those who have no means of protecting themselves against such disaster.

117. The conference recommends that the necessary authority be reposed in the proposed State Flood Control Board to approve plans for all such dams and reservoirs, to supervise their construction and to exercise such control over their maintenance and operation as may be necessary in the interest of public safety. The conference recommends also that such board be directed to make careful investigation of the works of any such reservoirs already built, with authority to prevent the use thereof unless they can be operated with entire safety. For purposes of the investigations suggested of new and old projects of this character, there should be appropriation sufficient to retain the services of engineers of experience and authority in such matters. The law, too, should impose penalties of imprisonment, rather than of fine, on those who deliberately or carelessly evade the law's intent and thereby create conditions which may endanger the integrity of the reservoir, and lead to disaster.

118. Chapter 491 of the California laws of 1915, amending section 637 of the Penal Code, approved May 24, 1915, provides in part that there shall not be diverted from any stream above a dam or artificial obstruction, water which may be necessary for fish life below such obstruction. It is the judgment of the conference that this provision of such act should be repealed, or so amended as not to offer any obstruction to the use of such water for beneficial use superior to the support of fish life.

CHAPTER V.

The Flood Problems of California.

119. California faces several great flood control problems (only one of which so far has been definitely solved and has progressed into a project in process of completion) and a number of smaller ones. No other state has so many or such weighty problems of this character. Fortunately, in all cases but one they are intrastate, and the opportunity is offered California to work them out if she will take the necessary steps.

Colorado River Floods.

120. The Colorado River offers the most complicated of these problems, not so much because of the physical features as because of interstate and international complications. The states of Colorado, Arizona, Utah, Wyoming and Nevada, as well as California, have interests in the stream; and Mexico has also, for it forms the international boundary between Arizona and Lower California, before it empties into the Gulf of California, eighty miles south. Until an adjustment is reached with the states named, no diversion for a beneficial use can be made by California with any certainty of permanently continuing such diversion; and Mexico declines to allow, without her consent, any diversion or use of the waters by California, on the ground that her treaty rights would be violated thereby.

121. The interests of California in the Colorado are varied. It is a source of danger, through overflow on American soil, in the stretch just below the Laguna dam, fourteen miles above Yuma. Above the dam for many miles it is confined within a narrow canyon. It is a source of greater danger to California through overflow on Mexican soil, threatening the Imperial Valley and the Salton Sink country. An inundation of this character in 1905 covered 445 square miles of the Salton Sink with water which is gradually receding through evaporation. The Southern Pacific Company spent over $1,000,000 in repairing this break and confining the river again.

122. The Colorado River may be of material benefit to California because it offers the only source of supply for irrigation of the rich Imperial Valley, the water for which, while diverted on American soil, is carried in canal through many miles of Mexican territory before it can be delivered to the valley. A great portion of the benefit to be had by California, as well as the menace threatened, therefore, necessitates the expenditure of American capital on Mexican soil, subject to such conditions as Mexico may impose. Certain lands in California under the Laguna Dam are also receiving water from the Colorado; and, if

the necessary diversion would be permitted, several hundred thousand acres of land in San Bernardino, San Diego and Riverside counties, which have no other available source of water supply, could be irrigated from the Colorado. (See "Flood Control and Reclamation in California," issued by State Reclamation Board, pp. 3 and 4.)

123. The Mexican Commissioner of Public Works on the Colorado River, who was in office at the time the recent revolutions broke out, Fernando Beltran y Puga, takes the position that Mexico is entitled to one-half of the waters of the Colorado passing Yuma, and that unless this be conceded she should fall back on her treaty rights, according to which, he claims, the United States has not the right to make any diversions from the stream without Mexico's consent.

124. This claim is probably founded on certain provisions of the treaties of 1884 and 1889 which recognize the center line of the Colorado River, (regardless of any changes due to natural causes, which may occur in the location thereof,) as the international boundary line between Arizona and Lower California. These provisions recognize the right of either nation to object to construction, dredging or other work which might tend to deflect the current or induce deposits, and produce a change in course of the stream. It is understood that the claim is made that diversions above, by reducing the volume of flow, might easily induce a change of channel in that section of the river forming part of the international boundary.

125. It is understood that Mexico, by act of congress and ministerial decree, has approved of diversion of waters from the Colorado River, either in Mexico or in California, and subsequently passing through Mexican territory, provided that she receive 50 per cent of the amounts so diverted at the minimum price for which the water is ever sold. This position as to division of the water has never been accepted officially by the United States, but was accepted by the California Development Company which then controlled the Imperial and Mexican canal systems.

126. The United States War Department, in 1910, decided that the treaties then in force and conditions existing prevented it issuing a permit for the construction of a dam and diversion of waters of the Colorado River; but a permit for construction of a certain type of dam was issued recently, although there had been no change in the conditions since 1910.

127. While navigation of the Colorado River has practically ceased, congress, because of the interstate and international complications referred to, makes frequent appropriations in the Rivers and Harbors Bill for levee work and other means of controlling the floods on this river.

128. The above statement of conditions sufficiently indicates the necessity for an adjustment of the conflicting state and national interests in this stream before a comprehensive plan can be adopted for its permanent flood control and for turning to highest beneficial use the great volume of water now largely wasted. It is elsewhere recommended that it be made one of the duties of the proposed State Flood Control Board to promote early adjustment of these interests and adoption of a state policy in connection with the control and use of these waters.

The Los Angeles Flood Problem.

129. The Los Angeles floods present a very serious engineering problem. The Los Angeles River is dry in summer, but in winter and spring carries torrential floods, sweeping away acres of orchards and depositing masses of silt in the harbor of Los Angeles. The maximum discharge of the stream is given as 31,140 second feet, but the damage done is out of all proportion to the amount of discharge because the area drained is comparatively small—534 square miles—and because the mountains are so close to the sea as to give high velocity to the waters. The damage done by the floods of this river and the San Gabriel and their tributaries in 1914 is estimated at $10,000,000 and in 1916 at $4,000,000.

130. The Los Angeles County Flood Control Board, composed of experienced engineers, has made a survey and report dealing with the problem and suggesting a plan for remedy. The plan proposed is to store as much of the floods as practicable in reservoirs; to hold back and retard the flow in the smaller canyons through check and saturation dams, which will also arrest the movement of debris ordinarily carried down and deposited in the main stream channels; to spread some over gravel beds where the streams debouch from the mountains, whence it will be conveyed by percolation through underground channels to the valleys below and there raise the water table and be available for pumping; and to dispose of what can not be cared for in any of these ways by diversion to the San Gabriel River and thence to the ocean where it will not injure a valuable harbor. The engineers have not agreed upon all the details nor can it be determined without further investigation just what part each of the remedial measures suggested may play.

131. The original plan for financing the project, as outlined in the bill introduced in the legislature of 1915, contemplated the assessment of a portion of the expense to lands benefited. This bill was withdrawn, however, and another substituted which provided for a bond issue by Los Angeles County organized as a reclamation district. It is under-

stood that another measure is in course of preparation for consideration by the coming legislature.

132. Congress, in the Rivers and Harbors Bill of 1916, provided for assistance to this project, or more correctly, to that portion of it which called for diversion of the Los Angeles River so as to prevent the deposit of silt in the harbor of Los Angeles. An appropriation of $500,000 was made for construction of a diverting dam, conditional that all expense other than that involved in actual construction of the diverting works shall be paid by the city or county of Los Angeles, or other interest.

133. The Los Angeles and San Gabriel rivers are typical of a number of coastal streams, among which may be named the Santa Ana, San Luis Rey, San Diego, Santa Clara, Santa Ynez and Salinas rivers, along all of which there is a large amount of flood damage.

134. The seriousness of the existing situation adds force to the recommendation of the conference as to creation of a state authority to assist in planning and carrying to completion projects necessary for the safety and prosperity of individual sections of the state.

The San Joaquin Valley Flood Problems.

135. Flood control of the San Joaquin River and its tributaries is placed under the jurisdiction of the State Reclamation Board by the Reclamation Board Act, the reason doubtless being that the San Joaquin and the Sacramento rivers to a certain extent must be handled together for flood control purposes, because of the way in which their waters mingle in a common delta and the menace which the debris-laden floods of the Sacramento offer to the lower San Joaquin. Some of the problems in connection with the San Joaquin are referred to in Chapter XII, "Storage for Flood Control." (Sec. 258.)

136. There is, as yet, no comprehensive plan for flood control in the San Joaquin Valley. Such a plan, however, will be developed probably during the coming year, for the surveys which must form the basis for any plan are now practically completed and data therefrom are being worked up in the office of the State Reclamation Board. These surveys were undertaken jointly by the nation, through the California Debris Commission, composed of United States army engineers, and the state, through the State Engineering Department. Plans will be prepared by the Debris Commission, as was done in the case of the Sacramento River, submitted to the Board of Engineers for Rivers and Harbors at Washington and, if approved, recommended to congress. If approved by congress they can be adopted by the state, as was done in the case of the Sacramento, and authority given to the State Reclamation Board, or some similar agency, to cooperate with the federal engineers in carrying out the project adopted.

137. The safety of the city of Stockton and protection of many thousands of acres of rich bottom lands in the valley are involved in the early completion of a project of this character, while the interests of irrigation could perhaps be incidentally served. The recommendations of the conference look to giving the proposed Flood Control Board jurisdiction over this project.

The Sacramento Flood Control Project.

138. Of the four big flood control problems of California, that of the Sacramento River is the only one that has had, for a term of years, a combination of these elements: exhaustive engineering investigation, formulation and approval of a detailed plan, adoption thereof by the state of California, and continued progress of the work under cooperation of national and state commissions created for the purpose. The Sacramento project, in consequence, is the only one for intimate investigation of which an opportunity was presented to the conference.

139. For detailed information in connection with this project reference is made to the following documents: Report of the House Committee on Flood Control, April, 1916, House Report No. 616, which affords the most comprehensive history of the project, its purposes and prospective advantages; Report of the State Reclamation Board, 1916, which outlines the actual progress of the work, methods of financing, etc.; the Reclamation Board Act, 1915, outlining the state's attitude toward the project and the powers and duties of the Reclamation Board in connection therewith. For purposes of this report and in order that certain recommendations herein made as to the project and certain suggestions as to reclamation may be fully understood it is necessary only to give the following points:

140. The Sacramento River calls for heroic treatment because of its great floods—now estimated at 660,000 second feet—fourth largest in actual volume among the rivers of the United States, and in proportion to territory drained, from four to fifteen times as great as any of the other three.

141. It is agreed that the by-pass system is the only one which will secure permanent flood control of the river. The plan contemplates retaining within the channel by strong levees so much of the flow as the channel can safely carry, thereby insuring scouring and deepening; diverting the excess floods at four points over waste weirs and carrying them through by-passes to Rio Vista, fifteen miles from the river's mouth; deepening and widening this fifteen mile stretch to accommodate the maximum floods; and providing that reservoirs hereafter installed for irrigation or power may fit into the plan and furnish additional

factors of safety to the extent of the volume of flood held back at the critical time.

142. The engineers explain that on the Sacramento River the interests of flood control, navigation, care of mining debris and reclamation are so interwoven that they can not be served economically by separate plans.

143. The project, as the only one which will serve these purposes, is necessary for the preservation of navigation in the Sacramento River and incidentally a protection to the lower San Joaquin as well; of value to inland waterways, and, therefore, to commerce; a necessity for permanent reclamation of over a million acres of rich bottom lands and for placing population thereon; the only means for permanently insuring safety from floods for the city of Sacramento and the state property therein. The report of the California Debris Commission, 1910, showed that the damage done by Sacramento River floods in 1904, 1907 and 1910 was $11,000,000. In 1907 San Francisco and Sacramento were cut off from rail communication to the eastward for ten days.

144. The work under the project is to be done as follows: That portion of it declared to be necessary in the interests of navigation and commerce, to wit, the construction of the four weirs, and the enlarging of the river's mouth, and any channel dredging, is placed under direction of the California Debris Commission, named by the War Department. The future expense of this portion of the project, estimated at $11,200,000, is proposed to be divided, half and half, between congress and the state of California. The remaining portion of the work, including construction of all river and by-pass levees and obtaining rights of way therefor, is under the direction of the state, acting through the State Reclamation Board, and the expense thereof, aggregating about $30,000,000, is to be met by assessments on the lands benefited in proportion to benefits received.

145. California formally adopted the project and in effect agreed to carry through her portion thereof by legislative acts of 1911 (special session), 1913 and 1915. The project was passed, in the Flood Control Bill (H. R. 14777), by the lower house of congress in May, 1916, and will come before the senate for approval at the December short session. The bill provides for an appropriation by congress each year of not exceeding $1,000,000 until the amount of $5,600,000 has been paid, on condition that California appropriate a similar amount. The annual appropriation named was based on the statement from the office of the chief of engineers for Rivers and Harbors that economical

efficiency would be best served if the project be completed in five or six years.

146. The Sacramento River flood control project is the only flood control project in the United States, except that of the Mississippi, which was ready by investigation, detailed plan, report, recommendation, approval and creation of necessary state authority for action by congress at the present session, and this fact gave it place in the Flood Control Bill. The attitude assumed by California in relation thereto and the harmonious cooperation had for five years past with the national authorities have placed the state in a unique position with congress, and her policy is being gradually made a standard which other states are asked to follow.

147. It should be remembered that the Flood Control Bill, while providing specifically for approval of the only two flood control projects in the United States prepared for such approval, also furnishes machinery under which any meritorious flood control project may be investigated, and after favorable recommendation by the Board of Engineers, receive approval and appropriation in the manner followed with the Mississippi and Sacramento projects. The machinery thus provided is a departure in the policy of congress, and it may be found of value in furthering other flood control projects of this state. Copies of the Flood Control Bill and other documents of interest in connection with this matter will be found among the papers submitted with this report.

148. Under cooperation of the state and federal authorities work on the Sacramento project is steadily advancing. A large amount of the river levee construction and some of the by-pass levees have been completed; while work in the river's mouth is proceeding under federal direction with state and national appropriations, made for what is locally referred to as the "minor project." (See State Reclamation Board report, 1916.)

Flood Control Recommendations.

149. The conference has recommended that the present powers of the State Reclamation Board in connection with the Sacramento Flood Control project be transferred to the proposed State Flood Control Board. With the increased jurisdiction given such proposed board, some of the complications which have hampered the efficiency of the Reclamation Board will disappear; and with desirable changes in the matter of financing and levy and collection of assessments, explained in Chapter IX, "Reclamation" (Sec. 201), and Chapter XVII, "State

Aid in Interest of Conservation" (Sec. 318), it is believed the Sacramento project can be assisted to early completion and blaze the way for successful prosecution of other similar projects.

150. The magnitude of the four problems named; the fact that in only one case has a plan for solution been adopted; the danger and loss which must result until permanent remedial measures have been carried to completion; the number of smaller flood problems, each important to its own district, would seem to offer ample justification for the recommendations of the conference looking to the creation of a State Flood Control Board with state-wide jurisdiction and ample powers; the thorough investigation of available reservoir sites; and state supervision and assistance in the construction of reservoirs and application of remedial measures, the state to be reimbursed by the interests benefited for moneys expended or credit loaned.

151. There is apparent, too, the necessity for the gathering of reliable data as to stream flow in flood season. Without such data it is impracticable to formulate flood control projects which will provide adequate protection when the great flood comes. The state therefore should at once take the necessary steps for systematic collection of such data. As indicating the necessity therefor the following facts are cited: In 1881 the official report of the Board of Engineers for Rivers and Harbors placed the maximum floods of the Sacramento River at 100,000 second feet; in 1904 the report of the "Dabney" Commission was based on a maximum of 250,000 second feet; the floods of 1907 carried 600,000 second feet; later floods in certain tributaries have demonstrated the possibility of a greater maximum; and recent investigations have caused some engineers to doubt that present estimates even approach the maximum flood the valley may some day experience. Again, the maximum flow of the Kings River has been estimated at 39,000 second feet; it flowed in 1914 for a short time 62,000 second feet. It is fairly certain that the flood possibilities of the other rivers which empty into the Tulare Lake have been very much underestimated; for instance the run-off of Kern River for the season 1915–16, as recently ascertained by the State Engineering Department, was 50 per cent greater than for the season 1905–06, which furnished the greatest previously recorded flow in that river. And by analogy it may be assumed that present estimates of maximum floods in other streams are equally unreliable.

CHAPTER VI.

Riparian Rights.

152. Owing to the character of climate and soil it has long been recognized that California has no more serious problem than that arising from the necessity for the economical use of its supply of water.

153. Broadly speaking, two divergent doctrines are recognized as controlling the right to use water. One is the doctrine of appropriation. Theoretically, this doctrine is recognized as existing in this state, but practically it is subordinated to the doctrine of riparian rights. With various unimportant modifications indicated by different writers, or suggested in different decisions, or arising from different conditions, a statement of this doctrine that can be accepted as substantially correct is, "Whoever first diverts the water of a stream and puts it to a beneficial use is entitled to the water so diverted so long as, and to the amount that, he puts to a beneficial use."

154. The other doctrine is inherited from the common law, and is that of riparian rights. The formula for this doctrine, which in its broadest terms admits the absolute ownership by the riparian proprietors of all the water in the stream to which their land is riparian, is that a riparian proprietor is entitled to have the water flow by his door undiminished in quantity and unpolluted in quality. The only limitations, broadly speaking, upon this right, seem to be: (*a*) The right of the public in navigable streams to maintain the navigability of such streams (1 Farnham on Water Rights, 136), and (*b*) The right of all riparian proprietors as between themselves to a reasonable use of the water (*Turner* vs. *James Canal Company,* 155 Cal. 182). In its broadest claim this doctrine recognizes no right in the public, or in persons whose lands are not riparian to the stream. It is questionable whether the courts of this state have gone so far as above stated in sustaining the rights of riparian proprietors, but it can not be said with certainty that such is not the law in California. (*Miller & Lux* vs. *Enterprise Canal Company,* 169 Cal. 447.)

155. Very early in the history of the arid and semiarid West it was recognized that this doctrine was not applicable to conditions there existing, and in the states of Colorado, Arizona, Idaho, New Mexico, Nevada, Utah, Wyoming, Nebraska, Oregon and Texas the law was either abrogated or materially modified.

156. Unfortunately, the courts of this state were called upon to adjudicate the question of water rights before the importance of irrigation was recognized, and without any legislative action attempting to limit or define the rights of appropriators, or of riparian proprietors.

In the absence of such legislation, the Supreme Court adopted the riparian doctrine from the common law. Thereby the rights of the riparian proprietor to the water flowing by his land became recognized as a vested property right, of which he could not be deprived without compensation, or due process of law (*Lux vs. Haggin*). Probably it is now universally recognized that the incorporation of this doctrine into the jurisprudence of California was a mistake, and that it is even more inapplicable to the conditions existing here than to the conditions existing in many of the states which have repudiated it. Nevertheless, it is the law of the state.

157. From time to time in various decisions the courts have intimated that possibly some relief might be found in legislative action, and there is a considerable amount of authority justifying the contention that, inasmuch as the right of irrigation was not one of the rights recognized under the old common law doctrine of riparian rights, the courts of this state, under proper legislation, could, without interfering with vested property rights, limit riparian proprietors to such amount of water as was actually being put to a beneficial use for irrigation purposes, treating them, so far as irrigation was concerned, as appropriators by nature, if this expression can be used, rather than as possessing the right as riparian proprietors to the use of water for irrigation. The fact that by constitutional provision the use of water is declared a public use and that most of our streams are tributary to navigable rivers over which, so far as navigation is concerned, the public has an undoubted right of control, strengthens the contention. (*Miller vs. Bay Cities Water Company*, 157 Cal. 256.) While the conference has recognized the possibility of such a contention being upheld, it has seemed best to suggest such legislation as might be sustained, even in the face of the extreme statement of the riparian doctrine hereinbefore given. The conference is in favor of legislation along other lines, if practicable, and there is no intention, at this time, to insist that the methods proposed are the only methods of overcoming this evil, but merely that they seem to be the most feasible.

158. The evils of the riparian doctrine are indicated by Mr. Justice Holmes in a recent case before the United States Supreme Court in which, referring to that doctrine, he said:

> "Such a limitation would substitute accident for a rule based upon economic consideration, and an effort, adequate or not, to get the greatest use from all available land."

And Mr. Justice Brewer has said, that under the law of prior appropriation, "barrenness disappears and the desert becomes a garden blossoming like the rose." (1 Weil Water Rights, 124.)

Particular Evils of the Riparian Doctrine.

159. *Uneconomic use.* It seems to be generally recognized that the supply of water available for irrigation in the state of California, if not actually less than that required, is at least so limited in quantity as to require the greatest possible economy in its conservation and use. One grave objection to the riparian doctrine is that it prevents such economic use. Under this doctrine, the landowners along the banks of the stream own all of the water (except perhaps the water from extreme floods) in that stream, and are entitled to enjoin any diversion of such water. In other words, it seems that they are entitled to insist upon the right to have divided among themselves all of the water of the stream. Since, of necessity, only a small portion of the irrigable land is riparian, large areas of land, if this doctrine is strictly enforced, would be deprived of water for irrigation.

160. *Insecurity of other rights to water.* The right to acquire this water for nonriparian land by condemnation or purchase does not remedy the evil, since such condemnation or purchase, to be of any value, must cover the rights of all of the riparian proprietors, and such proposed purchaser would be powerless upon any considerable stream to reach satisfactory terms with all riparian proprietors.

161. The only method by which any large amounts of water legally have been diverted permanently to nonriparian land has been by adverse use. This is too uncertain and risky, however, to be depended upon. The statute would not run against upper riparian proprietors, and the extent to which it would run in any particular case against lower riparian proprietors, naturally, is uncertain. The danger of suit for damage or for injunction before such title had been acquired by adverse possession, renders impracticable any considerable dependence upon this method of obtaining title. It has happened not infrequently that appropriators of water for nonriparian land have expended large sums in building reservoirs and other diverting works only to be enjoined from using the water after such works were completed. One must go upon the stream and build his diverting works to irrigate land, or his impounding reservoir to impound water for power purposes, or even such impounding or diverting works as may be desired for navigation, with the risk that at any time, before his interference with the flow of the stream has ripened into a right, through lapse of time, he may be enjoined by some riparian proprietor, who claims that such works interfere with the flow of the water, and lose all of the money expended in such work, or be compelled to bring expensive and protracted condemnation proceedings to condemn such adverse right, and perhaps in the meantime be enjoined from such use.

162. *Securities made uncertain.* As can be readily seen, the existing condition comes very near paralyzing all water development in the

state. Securities issued by companies desiring to develop hydro-electric energy, or to divert water for irrigation; bonds of irrigation districts; and, in fact, any securities based upon any use of water, run the risk of attack at any time until, by operation of the statute of limitation, or by prescription, the rights to such water have become perfected. As water becomes more valuable, and the riparian proprietors obtain a clearer understanding of their rights, it becomes increasingly difficult to develop any of the water resources of the state.

163. Summing up the situation, in its broadest terms, the doctrine of riparian rights, which seems to be the existing law in California, recognizes that the owners of land upon the borders of the stream, by reason of their riparian right, are the owners of all the water flowing in that stream, and that their right is a right of property of which they can not be divested without compensation and due process of law; that an owner of nonriparian land has no right to divert the water to that land against the objection of such riparian owners, and that no one has a right to build any reservoir in the stream (for generating power or for other purposes) which will prevent the flow of the water in its accustomed manner, to the land of such riparian proprietors, without their consent.

164. It appears further that the only way in which a right to divert or impound, or otherwise use this water, can be obtained is either by purchase from the riparian owners, or condemnation of their rights—which we have seen is hardly practicable—or else by the use of such water for a time which gives title by adverse possession. Since the right to water is a property right, it follows that such adverse user must continue for a period of five years before title is acquired thereby. One other limitation has been recognized, and that is that where the riparian proprietor has stood by and without objection permitted large public interests or extensive communities to be developed dependent upon this use of water, adverse to the rights of the riparian proprietor, such riparian proprietor will be estopped within a period much less than five years to object to such use.

Remedies Proposed.

165. Since the right of a riparian proprietor is a property right, it would seem that it can not be taken away from him either by legislative action or by constitutional amendment. Subject to the possible modifications, hereinbefore suggested, that the courts might recognize as constitutional such legislation as would limit a riparian proprietor to a reasonable and beneficial use as against both riparian land and nonriparian land, it would seem that any legislation aimed to remedy this evil must recognize this status. While the law can not take away a right to property, the legislature, within reasonable limits, can modify or

control the remedy applicable to the protection of that right. This control may apply to the method by which the riparian proprietor may protect his rights, and also to the time within which he must exercise the remedy given. The two logical methods of control then would seem to be, first, by the remedies allowed, and, second, by limiting the time within which the rights given by such remedies can be exercised.

166. After careful consideration, the members of the conference, while entirely sympathetic with any other method of attack, are inclined to suggest legislation along these lines, and have recommended the following three measures:

167. First, the enactment of a law under which, if a riparian proprietor sues to enjoin an interference with his riparian right, the person sued may come into court and in the same action have the court determine whether or not the riparian proprietor is damaged by such alleged interference with his right, and if so, and in proper cases, to determine the damage, and the conditions under which such proposed interference shall be permitted to continue. In other words, in effect, it would be permitting the defendant, in an injunction suit by a riparian proprietor, in the same action, to condemn the right of that riparian proprietor. It would seem that this remedy is eminently just. A riparian proprietor should not be permitted to enjoin the use of the waters of a stream unless damaged thereby. If damaged, and such damage was caused by one who had the right of condemnation, it is perfectly proper that in one action and at one time the whole matter should be determined. No right of the riparian proprietor is interfered with, and speedy determination of conflicting rights provided for.

168. Second, to prohibit the issuance of an injunction unless damage is shown by the riparian proprietors.

169. The third remedy proposed is materially to limit the time within which a riparian proprietor may bring an action to protect his rights.

170. It must be borne in mind at the present time that every phase of water development in the state is at the mercy of the riparian proprietor. A municipal corporation, seeking to obtain water for municipal purposes; an irrigation district, seeking to use water for irrigation; and either one of these public corporations or a private corporation seeking to develop water power, are subject, at any moment, to expensive and annoying litigation, and to the possibility of being enjoined by a riparian proprietor whose damage perhaps is speculative rather than real. The riparian proprietor for years has had the opportunity of utilizing the water which he claims. It is utterly impossible, in many cases, to get together all possible riparian claimants of the waters upon any stream in advance of the undertaking of a water development project, and therefore, under the present law, either the water must remain

unused, or the great risk must be taken of large expenditures, which may be lost. It follows that a very limited period should be prescribed within which a riparian proprietor is permitted to bring an action to prevent such development. The state is profoundly interested in encouraging the use and development to the utmost of its supply of water, and to the public it is not material whether that water be utilized by a riparian proprietor, or by some other interest, so long as it is utilized and the wealth of the state increased thereby.

171. It is proposed to enact a law under which a riparian proprietor must, within three months after notice of the proposed commencement of any work which he claims interferes with his riparian right, commence his action, or else be forever barred. The proposed law provides proper machinery to give notice to such riparian proprietor, and the riparian proprietor is protected to the amount of water which he is putting to a beneficial use at the time such water development commenced, or is in the process of putting to a beneficial use, with reasonable diligence. In other words, under this law, a riparian proprietor would be in a position to protect himself to the amount of water necessary for the beneficial irrigation of the riparian land owned by him, but would not be permitted to take a "dog in the manger" attitude, and claim more water than he was able to use beneficially upon his land.

172. It is the belief of the members of the conference that these three remedies will go very far toward eliminating the most serious evils connected with the doctrine of riparian rights, and that they do not interfere with, or infringe in the slightest degree upon, any vested right, and do not work any hardship upon any riparian proprietor.

CHAPTER VII.

Irrigation.

173. Physical conditions in the state, while necessitating irrigation, are particularly favorable for such irrigation. The irrigable valleys are comparatively narrow, while upon the high mountains the water is stored in the form of snow until, under the warmth of the advancing season, the snow melts at the time when there is the greatest need for water. The one drawback arises from the fact that the melting snow comes down more rapidly than it is possible, and somewhat earlier than it is desirable, to use the water, so that, unless storage is provided for such water, much of it runs to waste and the land is deprived of the later irrigation which is very desirable. Here again nature has been kind, since there are in the mountains many ideal reservoir sites in which the water can be stored with comparative economy. It is within the limits of possibility that most of the water which could be used for irrigation, and which now runs to waste, could be stored in such reservoirs so as greatly to increase the irrigable acreage, and materially to extend the irrigating season for the land already irrigated, thus adding much to the wealth of the state. While the examinations which have been made would seem to indicate that there is more irrigable land than there is water which can practically be applied to the irrigation thereof, yet it is probable that by a systematic plan of storage and the proper conservation by winter irrigation, and the use of underground water, a very large portion of the irrigable land in the state could be provided with a reasonably adequate amount of water. So stupendous is the possible addition that this would make to the wealth of the state that one hesitates to make even an estimate.

174. It must also be remembered that hand in hand with the great economic loss annually suffered by inability to obtain water for the irrigation of the arid land goes the damage to the swamp and reclaimed land by floods. Another drawback to the industrial development of California, particularly before the development of the supplies of oil, was the lack of cheap fuel, and it should be realized that the proper conservation and utilization of water for irrigation may be so accomplished as materially to lessen the damage from floods and greatly to increase the opportunity for the development of power for the generation of electrical energy, so that the reclamation from aridity of the agricultural lands of the state carries with it material reclamation of flooded lands and the possibility of a great increase in power development. We believe that all projects should be developed with these three objects in view. This proposition is now so well known and so

universally accepted as to be elemental. Unfortunately, however, a full realization of the full importance of this problem comes slowly.

175. In the beginning of our state history no legislative programme had been outlined relative to the use of water, and there were no legal precedents in the United States to guide the courts. In the absence of legislation and precedents, and in the absence, on the part of the judges, of practical experience, they were compelled to grope in the dark and to follow, as best they could, the precedents of the common law. The result has been the recognition and the establishment of the riparian doctrine which has made it very difficult to bring about an efficient and economic distribution of the very inadequate and badly distributed water supply of the state. Many early projects thereby secured a greater proportion of water than was essential to proper irrigation and obtained priority which deprived other and adjacent land of a proper water supply, or imposed upon that land burdensome conditions and expensive charges.

176. It was assumed in the beginning, as, unfortunately, has been assumed with regard to most of our natural resources, that the water supply was unlimited. This led not only to unjust priority and wasteful use, so far as the rights of the consumers were concerned, but also to wasteful methods of measurement and distribution. Where water was abundant, the only limitation in its use would be that such use should not interfere with the rights of others using from the same stream or from the same ditch. The result was that there grew up the practice of measuring the amount of water to which a person was entitled, not by the amount, but by the loose method of the length of time required to irrigate, or by the acreage irrigated. Instead of measurement by the acre foot, measurement by second feet grew up. Theoretically, of course, a certain amount of water delivered for a certain length of time would cover the land to be irrigated to a certain depth, but practically, the method has resulted in paying little attention to the actual amount of water delivered, or to the economical time of use. The method to which probably we should ultimately come, where the water will be efficiently used, is to determine the actual quantity delivered, so that it may be measured by the acre foot, or by the actual amount of water delivered, and no one should be permitted to have more water than he can efficiently utilize.

177. This would lead, of course, to the control by the state of the distribution of the waters of a stream to the various users from that stream, which will be treated elsewhere in this report.

178. The necessity for irrigation forced its practice in the arid regions of the state, and the satisfactory result thereof has caused it

gradually to spread to the less arid portions until it has become doubtful whether irrigation may not be profitable even where the rainfall is the greatest.

179. Naturally, the first attempts at irrigation were with the water easily accessible to the land adjacent thereto. While this method of development was natural, and apparently unavoidable, and has worked out reasonably efficiently and satisfactorily, yet it involved a wasteful use of this very valuable resource of the state. Had it been possible in the beginning carefully to have determined the lands which were susceptible of irrigation from any one stream, and then to have applied a comprehensive system of reclamation and distribution, to the end that all of the water in such stream should be utilized most efficiently and economically for the irrigation of the lands dependent thereon, while the cost of irrigation to some of the land would have been in excess of what it is under the conditions of development that have taken place, as to all of the lands dependent upon such streams, it would have resulted in applying water at a very much less cost than it can hope to be applied under existing system.

180. The first development undertaken, of course, was the result of private enterprise. It was entirely practicable and comparatively easy for owners of land, easily and cheaply irrigable from a stream, to get together, and, by combined action, provide for the irrigation of their land; and it was equally easy for one or more large landowners owning land so favorably situated, to construct an irrigation system that would carry water to all of the lands owned by them, and then, in selling the land, to reimburse themselves for the cost of such irrigation system. Thereby they not only brought to themselves considerable profit, but furnished to the ultimate owners of the land a comparatively cheap system of irrigation. The land, however, subject to such easy and economic irrigation, was not very extensive, and irrigation development soon reached a stage where the initial outlay was so great that in view of the delayed returns which resulted from the naturally slow utilization of the water on large tracts of land, it became unprofitable for private enterprise to attempt the irrigation of large tracts of land remaining unirrigated.

Irrigation Districts and Their Bonds.

181. In this stage of development it became necessary to provide a more efficient method for combining the interests of the owners of numerous tracts of land for the purpose of providing water for the irrigation thereof, and in 1887 the first genuine district act was passed. This act, as is the present act, was an attempt to apply to the problem of providing water for irrigation a combination of the machinery and

municipal power possessed by school districts and municipalities. Its success has demonstrated its feasibility, and at the present time it appears to be the most practicable means by which large tracts of very productive, but arid land, can be reclaimed and brought under irrigation.

182. Unfortunately, but very naturally, since it was a new departure in legislation, the original law had many defects. Numerous districts were failures. Looking back, however, at this time it can not be said with certainty that such failures were entirely the result of defects in the law as it existed at that time. The law went into operation at a time of a widespread financial depression. Many districts, organized in good faith, started out and expended a considerable sum of money in constructing a portion of an irrigation system, only to find that it was impossible to market their securities and complete the system. In such a condition, where a community was confronted with a large bonded indebtedness for an uncompleted irrigation system from which no water could be obtained, and with the absolute refusal of the financial interests of the state to come to the aid of such districts, discouragement resulted and repudiation was attempted. It is probable, however, that if there was any blame for these failures, it was more largely chargeable to the shortsightedness of the financial interests of the state than to the ignorance, incapacity, or dishonesty of the communities attempting to organize these districts, or to the internal opposition which naturally met a new departure so radical in its nature.

183. As a concrete illustration of the situation, the Modesto district is typical in this regard. That district organized and spent $800,000 in the construction of a diverting dam and its main distributing canal. At first its securities sold fairly readily and there was every reason to believe that it would be able to sell the remainder of the bonds authorized so as to bring the water to the land. At this stage, however, it became impossible to find any purchasers for the remaining bonds of the district. Without irrigation the existing debt was very burdensome, and it was almost impossible for the landowners to meet the interest charges upon a worthless system. The people were perfectly willing to sell the authorized bonds, and, if necessary, to authorize more bonds for the completion of the system. No one was willing, however, to take such securities and apparently the holders of the outstanding bonds were rather willing to risk the loss of the money already invested than to invest a little more with the hope of success. It was only after repeated conferences with the holders of the bonds that the people in the district were able to work out a solution of the problem. Many times it seemed that the whole project must be abandoned because of

the apparent impossibility of financing what the residents of the district knew to be an absolutely safe proposition. Now the bonds of the Modesto Irrigation District are recognized as among the very best municipal securities in the state. This is given merely to illustrate the fact that in all probability had the people outside of the arid regions appreciated as strongly as did the people in those regions the importance of irrigation, and been ready to meet halfway the people desiring irrigation, the bulk of the districts which did fail would have been carried to a successful termination, and no loss would have been suffered by the holders of bonds. The same attitude of financiers toward any city or school district would have brought the same results it did in irrigation districts.

184. In 1897 a new act was passed which attempted, and quite successfully, to remove the defects which experience had shown existed in the original act. No irrigation district organized since that time has defaulted or delayed in the payment of the principal and interest upon any securities issued by it.

185. In spite of this fact, however, it was still difficult for the irrigation districts to sell their securities, and in many cases excessive discounts were required. From time to time, and in nearly every session of the legislature, trifling amendments have been made, chiefly at the suggestion of various bankers or representatives of bonding houses, seeking to overcome this condition. The result of the legislation has been that the securities of irrigation districts are much more strongly safeguarded, and the provisions for the enforcement thereof are much more drastic than is the case with any other municipal securities in the state. It was natural, however, that such legislation by piecemeal should result in some discrepancies, and in unnecessarily complicating the machinery of the districts. This conference is not suggesting any very marked changes in the law, and the amendments suggested are largely for the purpose of removing these discrepancies and apparent contradictions and of simplifying procedure. It is also desired to render easier cooperation with federal authorities under the national Reclamation Act.

186. Some of the first attempts to strengthen the bonds of the districts were along the line of rendering more difficult the organization of districts, with the purpose of requiring almost unanimous action on the part of landowners. In view of subsequent legislation which has thrown drastic safeguards around the issuance of bonds, it has been thought that it might be wise to render somewhat easier the organization of a district—depending upon state supervision and drastic regulations with regard to the issuance of bonds to afford protection rather than the making difficult the organization of a district. The

conference believes that it is a matter of profound importance to the people of California that the organization of districts be encouraged wherever they can safely be organized upon a basis which insures their successful and economic operation. It is equally essential, however, that the securities of these districts be placed in a position absolutely beyond question, and these are the two objects which the proposed amendments have in view.

187. A very careful examination of all the conditions surrounding the organization and operation of the irrigation districts in California leads to the conclusion that the difficulties which have been encountered and which now exist, as is hereinbefore suggested, arise more largely from a lack of sympathetic cooperation on the part of the business interests in California than from any other cause. We believe that the district system as it now exists provides an efficient and economic method for the irrigation of land which otherwise it would be impossible to provide with irrigation facilities, and we believe that the safeguards now thrown around the issuance of bonds renders these bonds practically as safe investments as any other municipal bonds in the state.

188. There still remains much unirrigated land, and a sufficient supply of unused water beneficially to irrigate much of that land. The development of the state requires the combination of that land and water. The district system furnishes an almost ideal method for the distribution and management of such water. The security for the needful outlay is ample. All that is required is to form a connection between this land and water and the money. In spite of all attempts in the past, and in spite of the fact that the district system furnishes drastic machinery for the protection of the investor, the fact remains that, except at the expense of unreasonable discount, it is very difficult to finance such irrigation projects. They are too big for the people concerned to finance, and outside capital is too shy. The only recourse seems to be for the state to step in and entirely finance such projects in a manner something similar to that used by the federal government in irrigating public lands—by state guarantee of irrigation securities, or by some modified plan.

189. The conference has suggested two measures. One is a safe method of state guarantee; but as it will require a constitutional amendment, and take four or more years to put it in operation, a temporary expedient is suggested. This is the creation of a revolving fund with which to purchase the coupons of irrigation, reclamation and drainage districts, and in case of failure to repay the taking over by the state and the management of such districts until repayment. Inasmuch as the defaulting in an irrigation bond is unknown since the act

of 1897, there would seem to be no risk or expense imposed upon the state, but at the same time a sufficient insurance put upon the bonds to assure their ready sale.

If it should happen that such districts should default, the proper state authority would immediately step in and take charge of and collect all revenues, etc., until the state is repaid.

190. With regard to the irrigation district law, there are two different points of view. One favors provisions which will admit of increased control by the state authorities, not only in the organization and issuance of securities, but in the management and operation of irrigation districts. The other strongly believes in the doctrine of local self-government, and insists that so far as it can be done with safety to the holders of the securities of districts, that the affairs of the district be left in the hands of the community in which it exists. All are united, however, in the belief that there should be given to the state such amount of control as will prevent absolutely, in the first place, the issuance of bonds, without adequate security, and in the second place, power to enforce, without any delay, reservation or hesitation, the prompt and complete payment of all obligations of the district. These, the conference conceives to be the essential matters, and therefore has not attempted to make any recommendation with regard to the administrative question upon which there is a difference of opinion, believing that time will work out the result which experience shows to be most desirable. Since it is proposed that the state shall assume somewhat greater responsibility in financing these districts, it is also suggested that the state shall have greater power in supervising the expenditure of such money.

191. The conference, however, does not wish to be understood as suggesting that the district system is the only method of irrigation. Unquestionably there are places where mutual water companies can be organized to advantage, and will afford a somewhat simpler method than the district system. There are conditions where private ownership and the sale of water to users under a fixed charge may afford the most satisfactory and efficient method, and it is our belief that the laws of the state should be so liberal as to give the greatest possible encouragement to utilization of the waters for irrigation in any method which may be found most convenient, most efficient, or most economical.

192. We believe that, to a very considerable extent, the future prosperity and the possibility of the increased prosperity of the state depends upon the utilization of its water supply; that it is desirable, so far as possible, that such development take place as to admit of the most complete use of the water, not only for irrigation, but for power and navigation; and that it is possible in most cases so to coordinate these various uses that one will not interfere with the other.

CHAPTER VIII.

Underground Water.

193. The question of irrigation from underground water is of increasing importance. In round numbers, there are located in the San Joaquin Valley alone over eight million acres of irrigable land. Just how much of this land can be irrigated from surface water is still a question, but it is safe to assume that there are two or three million acres in the San Joaquin Valley alone which will have to depend, either entirely, or to a very great extent, for irrigation upon pumping from underground water, or else do without water. South of the Tehachapi this method of irrigation by pumping has reached a larger development at the present than north of the Tehachapi, but conditions indicate that in both the San Joaquin and Sacramento valleys and in some of the coast valleys, the pumping question is of increasing importance. Up to the present time the legislature has not attempted to define the right of users of underground water. The matter has been left to the courts to decide each particular case upon its own merits. This method is neither just to the courts nor is it apt to be wise in its result. It is not right that legislation upon matters of such importance should be forced upon the courts, but to leave the matters unsettled by the legislature is to compel judicial legislation. It is largely owing to such legislative neglect that the very unsatisfactory condition has arisen in this state with regard to riparian rights, and it seems very important that at this time, before any serious evil has resulted, the legislature declare clearly the basic principles upon which the right to underground waters shall rest.

194. At the present time, so far as the matters have been adjudicated, the doctrine seems to be that land overlying a clearly defined body of water is entitled, as between all the landowners, to a reasonable use of that water. It would appear that under this doctrine it might be possible, if the water was insufficient for the purpose of all landowners, so to divide the supply that it would be of no benefit to any one. The doctrine further appears to be that no one has a right to pump from such underground supply and convey the water for use to distant land to the damage present or prospective of any landowner whose land overlies the supply of water, unless perhaps such right may have been acquired through lapse of time, or by neglect under the doctrine of the statute of limitations or of estoppel. This is applying, to a considerable extent, the doctrine of riparian rights (which has been found so obnoxious) to underground waters, and probably would result in the same evil which has resulted from the riparian doctrine as to streams, namely, a failure, through fear of consequences, to use the water on distant lands, accom-

panied with the failure of the overlying land to use it at all, and thus prevent the utilization of what otherwise would be an element of value to the entire people.

195. The further condition exists with regard to underground water that very often the water is found lying under land of comparatively little value, whereas the more valuable land has under it no adequate supply of water, and if this doctrine is to be adhered to, the land really worth irrigation might be deprived of a supply of water which would be held to be appurtenant to land upon which the use of water would be of little value.

196. With reasonable protection to the owner of land under which there is the supply of water it seems eminently proper that the man who first has the energy and enterprise to develop a water supply should be entitled to the beneficial use of that water, no matter where he may use it, and that it is not in accordance with sound principles of public policy to permit the lethargy, delay, selfishness or ignorance of a landowner, who may happen to have water lying under his land, to prevent, practically forever, the utilization of the water.

197. The conference therefore has recommended legislation which will recognize the doctrine of prior appropriation as applied to underground water, so that the one who first develops it shall be entitled to so much water as is necessary for the beneficial use of the project to which it is applied.

198. The conference recommends, however, that the doctrine of appropriation be coupled with recognition, so far as practicable, of the doctrine of reasonable use, so that the prior appropriator shall be given no right to insist that the water level be maintained at the depth to which it was reduced by him, and that subsequent users may be permitted to pump from the same source although such pumping may materially reduce the water level, so long, however, as that level is not reduced below an economic depth. It is believed that in this respect an elastic rule should be established, under which each particular case may be determined upon its own merits. For example, it is feasible to pump to a much greater depth for citrus fruit than it would be for alfalfa. No arbitrary rule can be adopted.

199. In order to effectuate this combined doctrine of appropriation and of reasonable use it has been considered that the appropriation of underground water, like the appropriation of surface water, should be placed under the control of the State Water Commission, but that no owner of land of 160 acres or less, should be compelled to apply to the Water Commission for permission to develop the water lying under his

own land for use upon that land, and that the owner of a larger tract should be permitted to develop water under any particular 160 acres thereof for use upon such 160 acres by filing with the Water Commission a description of such 160 acres and his intention in regard thereto.

200. It is believed that this legislation will admit of the widest possible and most efficient use of underground waters, and will work no hardship upon any owner of land. At the present time an owner of land who seeks to develop underground water and carry it from the place of development is in the same danger as the owner of nonriparian land who seeks to appropriate water and carry it for the irrigation of his land. Each of them after the expenditure of large sums of money, and the development of expensive improvements, runs the risk of having all of his labor go for naught because, in one case, the owner of overlying land, and in the other, a riparian proprietor, may, out of mere maliciousness, insist upon his right that the water shall not be carried to distant land.

CHAPTER IX.

Reclamation.

201. The reclamation discussed in this report is the reclamation of lands subject to overflow from river floods, and therefore dependent on flood control. The reclamation of tide and marsh lands is largely a matter of drainage and tide levees with which it is not necessary to deal specifically in this report.

202. The consideration of the big reclamation problems of the state offers striking demonstration of the absolute necessity, in connection with each such problem, for the formal adoption of a comprehensive plan, and the creation of a state authority which can force all localities to so handle their projects that one shall not interfere with another. Some of the principal factors of these problems are here presented in order that the recommendations of the conference may be fairly weighed.

203. The flood problem of the Sacramento Valley has received more careful investigation than any other, and a study of the data available in connection with it furnishes more information in regard to the state questions involved in reclamation than can be found elsewhere. The Sacramento problem and the project adopted for its solution are sufficiently explained in Chapter V, "Flood Problems of California" (Sec. 119) and Chapter XII, "Storage for Flood Control" (Sec. 258), and in the authorities quoted therein. A reference to those chapters will make clear the reclamation phase of the Sacramento problem to which attention is now directed.

204. The flood problem of the Sacramento has been created partly by deposits of mining debris, but it has been enlarged and complicated by the unrestricted acts of individual owners and reclamation districts in attempting to protect their lands against overflow. What is said in this regard applies with equal force to conditions in the San Joaquin Valley and wherever the land owner must protect himself by levee against inundation from flood waters.

205. In early pioneer days reclamation by leveeing commenced along the Sacramento and San Joaquin rivers and in the joint delta of the two rivers. On the Sacramento the richest land was that nearest the river bank, and it was also the highest and best for levee construction, and levees in consequence were built close to the river bank, thus confining the floods to a narrow channel. On the San Joaquin River landowners showed a more intelligent conception of the problem by building levees farther back from the bank, and conditions somewhat favored them in this regard.

206. Originally the Colusa, Sutter, American, Yolo and Sacramento basins served as detention reservoirs to relieve the Sacramento River channel of a certain portion of the floods. In time these basins were ensmalled, or entirely closed to the floods, by construction of river levees for reclamation of farming land. Every levee thus built, every reclamation district thus created, withdrew more or less reservoir capacity which had theretofore served for flood relief. When "A" protected his land by a levee on one side of the river he pushed the water over on to the land of his neighbor "B," on the other side of the river; "B" in self-defense also built a levee, which forced water on to "C" and back on to "A"; and each reclamationist, while thus leveeing against his neighbor, was also raising the flood plane on his own levees.

207. As reclamation increased and more and more land was withdrawn from overflow, the river levees had to be steadily raised to keep above the increased volume of flood forced into the channel. This reclamation work and the debris deposits necessitate today at Sacramento City levees eight to twelve feet higher than were needed in 1860. It was quite evident therefore that the time must come under existing conditions, when the river levees, to prevent inundation, would have to be so high, and therefore so wide at the base and so expensive, as to exceed for construction and maintenance in some cases, any possible value of the land itself. Every district and every landowner, too, was dependent for safety as much on the levees of his neighbors, above and below him, as upon his own levees, and he had no power to ensure construction and maintenance of proper levees by those neighbors.

208. The state law in regard to reclamation, as declared by the Supreme Court in various cases, is in effect that a landowner has the right to protect his own property against the common enemy, flood waters, by leveeing, even if in so doing he forces them on to a neighbor's land; but he may not divert drainage waters on to a neighbor's land, though he may conduct them out of their natural channel, around or through his own property, and back again into the natural channel, provided, in so doing, the property of his neighbor is not injured. For sixty years reclamation in the Sacramento and San Joaquin valleys has been prosecuted in accord with the principle thus enunciated.

209. Manifestly the system of individual levee building by which each owner, in enclosing his own land, forced water upon his neighbor and ultimately raised the flood plane against his own levees, could not indefinitely continue. The amount of expense involved in keeping levees above the rising flood plane, the losses sustained by frequent inundation, some due to poor levees or careless maintenance in adjoining district, and some due to the volume of flood which no levees could confine to the narrow channel provided, grew to enormous proportions.

Reclamationists, who had consistently fought each other for fifty years while the floods destroyed their property, finally realized that safety could be secured only by joint action against the common enemy. Thus there came about cordial endorsement and prompt acquiescence when the United States government formulated a comprehensive plan under which reclamation, as well as navigation, might be conserved. It was certain reclamationists who asked the legislature to confer upon the State Reclamation Board those very drastic powers which enable it to compel all landowners to conform to the general plan, and to prevent any individual from creating general danger or precipitating disaster through obstinacy, carelessness or neglect.

210. The great interest of reclamation in the Sacramento project is explained when it is understood that the project provides for automatically discharging excess floods of the river channel as soon as the flood plane reaches a fixed height, so that districts and landowners can build permanent levees and know they will not have to raise them in a few years; that authority is reposed in some one to force all—the willing and the unwilling, the careless and the obstinate—to so handle their reclamation that the general interest may not be jeopardized; and that the expense for that part of the work for which reclamation is to pay is assessed on lands benefited thereby, in proportion to benefits received.

211. The Sacramento project is primarily a flood control project; but in providing for flood control and thereby preserving navigation it incidentally directly reclaims a great deal of rich land, and provides conditions under which other lands—not otherwise reclaimable—can be reclaimed by construction of the necessary works. The acreage of rich river lands in the Sacramento Valley thus benefited, including those now reclaimed but whose reclamation will be made safe, those now unreclaimed but which will be reclaimed by the project levees, and those unreclaimed whose reclamation will be made possible, amounts to 1,250,000 acres. In addition there is a large acreage in the San Joaquin Valley menaced by Sacramento River floods which will benefit materially by completion of the project. It is quite proper that the land benefited shall pay a fair proportion of the expense; and it is called upon to pay all cost of the project in excess of $11,200,000, the share declared by the federal engineers to be properly chargeable to commerce and navigation. That excess amounts to about $30,000,000, a considerable portion of which has already been expended.

212. The physical conditions in the San Joaquin Valley, so far as they affect reclamation, are somewhat similar to those which exist in the Sacramento, making allowance for a flood volume about one-fourth as large and a valley floor over twice as extensive. The difference in

those conditions is explained elsewhere in this report. (Chapter V.) The position of the reclamationist in the San Joaquin Valley is different for this reason; there is not yet a comprehensive plan of flood control formulated for the valley. Such a plan will probably be ready for consideration next year, and it is the apparent intention of the present Reclamation Board Act that, when such plan has been formally adopted by the state and congress, it shall be pushed to completion under cooperation, in the same way that the Sacramento project is now being pushed. The act now gives authority to the Reclamation Board to pass on all plans of reclamation in that part of the San Joaquin Valley included in the Sacramento and San Joaquin Drainage District, extending south almost to Fresno, and no reclamation work therein may be done without the board's approval. But in passing on any private reclamation plans, the board is handicapped by the absence of a state plan for the valley, and in consequence can only grant authorizations subject to such changes as may hereafter appear to be necessary when a flood control project for the valley shall have been adopted. There are certain portions of the valley, too, notably the Tulare Lake District, not under general jurisdiction of the Reclamation Board, and where, in consequence, local friction militates against early adoption of comprehensive reclamation plans.

213. Reclamation is concerned in the flood control of the Colorado River because of the danger to the rich Imperial Valley and other lands along the river as elsewhere explained. (See Chapter V.)

214. The character of the Los Angeles River is different. There are absent the swamp lands and low river bottoms subject to overflow, and which can be protected only by levee; but there are, on the other hand, the rich orchards which are actually washed away by the torrential floods sweeping down the river's course and overrunning its banks. And these waters must in some way be kept away from the orchards, as they are from alluvial bottoms on other rivers.

Suggested Remedies for Existing Evils.

215. The past five years experience in connection with reclamation on the Sacramento River has furnished lessons which are being heeded by reclamation interests throughout the state, and which furnish in large part the basis for the recommendations of the conference in connection therewith. Landowners who have fought each other for many years in the Sacramento Valley now agree that success and common safety can be secured only by a comprehensive plan, and under state authority, with such powers as can force compliance with the adopted plan on the part of all individuals.

216. The conference recommends that the necessary authority referred to be reposed in a State Flood Control Board, which shall take over the

duties of the present State Reclamation Board; that it be given statewide jurisdiction in all matters of flood control, reclamation and drainage; that all reclamation districts be required to submit their plans to it for approval and to be under its control so far as concerns construction and maintenance of flood control works; that the districts themselves be encouraged to administer their own internal affairs and construct their own works under general state law looking to efficient administration; but that the board may enforce construction, or itself construct, works necessary for general protection and neglected by the proper district or authority. The conference further recommends that the creation of individual reclamation districts by special legislative act be no longer permitted, and that new districts be forced to organize under general state law in compliance with the conditions and subject to the supervision and approval therein provided; and that any change in the present law required to make such special legislative act unnecessary in certain cases be made.

217. In the existing plan for the Sacramento and San Joaquin Drainage District there have developed these grave defects: The assessment plan, modeled on that which obtains in reclamation districts, is cumbersome and expensive, and involves great delay; there is no provision for bonding, and assessments must be paid in cash before the land is reclaimed and prepared for cropping, such assessments being frequently several times the actual value of the unreclaimed land and beyond the resources of the owner to pay; in the practical operation of the present Reclamation Board Act it has been demonstrated that the plan of constructing the project by units and levying assessments accordingly, as required by section 13 of the act, will not in many cases permit a fair apportionment of the expense in accordance with the benefits to be secured from the completed project.

218. In view of these conditions the conference recommends that the financing of the Sacramento Flood Control project be so changed as to conform to the following plan, which, though open to some objections, has decided merit as compared to the present one. The same recommendations may apply if desired, to the San Joaquin flood control project when it has been formulated, and to other projects involving the element of reclamation or protection to lands.

(*a*) Provide for a bond issue of the district sufficient to cover the entire cost of the project, including not only the work to be done, but also what has already been done in conformity with the plans.

(*b*) During the period of construction of the project—say for five or ten years—let the interest on the bonds be paid out of the bond fund itself; also payment of installments on the principal of the bonds should not commence until the project has been completed. Thus, the land will not be called upon to pay anything until it has received the benefit to be paid for.

(*c*) Levy one main assessment to be collected in installments, as required for payment of the bonds.

(*d*) Apportion and spread the assessment over the lands benefited in proportion to benefits received, only after the project has been completed, when those benefits can be defined with least question.

(*e*) Allow each landowner credit against his assessment for any amount he may have paid in for construction under any previous assessment. Allow credit also to any landowner or district for the value of levees or other work done at his or its expense in the past and utilized as part of the comprehensive flood control project. (The present act allows credit for construction done by individuals or districts since passage of the act, but not for previous construction.)

(*f*) Base the benefits received by any tract of land generally upon the difference between the value of such land, as fixed by the county assessor, before construction of the project, and the value of the land as fixed by the county assessor after completion of the project.

(*g*) Let the Reclamation Board, or its successor, sitting as a board of equalization, pass upon special cases, where there may be contributing causes for the increase in value of land other than reclamation; or where there are elements of benefit not properly represented in the assessment.

(*h*) Let the State Board of Equalization on appeal from a sufficient number of owners in any county, determine whether an injustice has been done by the assessor in any county by making assessments prior to the inauguration of the project too high, or by making assessments subsequent to completion thereof too low, so that the difference may not fairly represent the benefits received by lands in that county, and thus throw an additional burden on other counties. In such case let the State Board of Equalization have power to raise or lower the assessment value on all lands within the Sacramento and San Joaquin Drainage District in any county by a certain percentage, for purposes of the flood control project assessment only.

(*i*) Let the collection of assessments to meet principal and interest be made through the machinery of the county tax collector's office, and the bonds of the district be underlaid by the bonds of the state as fully explained in Chapter XVII, "State Aid in Interest of Conservation" (Sec. 318).

219. As the plan above recommended can not be made operative for two—and possibly four—years, the Sacramento and San Joaquin Drainage District will be at a most serious disadvantage in the meanwhile unless the legislature provides means by which the district can issue bonds.

220. In the great acreage of rich land which can be permanently reclaimed for intensive cultivation and settlement, and in the safety of established cities in districts subject to overflow, the state has certainly sufficient direct interest to justify the policy of state aid suggested in Chapter XVII of this report, and the creation of a state authority with power to standardize reclamation projects and save the reclamationist from his neighbor as well as from himself, as outlined in Chapter III.

CHAPTER X.

Inland Waterways.

221. The Water Problems Conference, by formal resolution at its session March 24, 1916, pronounced inland navigation as "of vital importance in the development of resources of the state," and declared that "if in the future it should appear necessary to take out of a navigable stream for irrigation so much of its flow as to endanger navigation, then if such navigation be necessary in the state's interest for insuring profitable markets for the products of irrigation, navigation should be maintained by canalization." Further investigation by the conference has furnished striking evidence of the unusual opportunities offered by California for development of inland waterways and of the important part they can play in utilization of the state's resources, and in promoting its growth in commerce and population.

222. For any necessary details as to the general advantages to be secured from inland waterways, the experience had therewith in this and in other countries, the low freight rates secured thereby in certain localities in California, the conditions in this state which lend themselves to development of an inland waterways system, and the part such waterways play in commercial development, reference is had to Appendix "A" to this report, "The Economic Value of Inland Waterways to California." (Sec. 352.)

223. It is only necessary to suggest here that such waterways offer generally the advantage of lower rates than rail transportation; a safeguard against monopoly or control of transportation so long as an individual can own a gasoline launch and a tow barge; and the opportunity, through low rates to tide water, to place products of the interior in the hold of ocean going steamers bound for world markets, and thus make profitable the intensive cultivation of the interior, with increase in population and wealth. Ninety per cent of all the commerce between Sacramento and San Francisco, and between Stockton and San Francisco is carried by water at 35 per cent less than rail rates; Napa and Petaluma, because of their location on small streams emptying into San Francisco Bay, enjoy low freight rates; above Sacramento City on Sacramento River, farmers have their produce hauled ten miles to the river by truck and then by barge to warehouse and market at 20 per cent less than rail rates; and similar advantages could possibly be secured by an adequate inland waterway system for most points in the Sacramento and San Joaquin valleys. It must be remembered that in all these cases the rail rates would probably be much higher were there no water communication. (Secs. 350-354.)

224. In considering the possible benefits to the state in increased commerce, wealth and population to follow in the wake of the establishment of an adequate inland waterways system, it is well to remember that in nearly all instances furnished by other countries and other states of surprising growth from use of canals (Secs. 340–349), such localities are unable to utilize this method of transportation during certain months because of ice; while in California there would be no interruption to navigation during the year.

225. Gauged by standards well established by the experience of other countries and other states, California is ideally situated, enjoying natural advantages far beyond those to be found in any other state of the Union, and apparently justifying a large investment of capital in improving and extending her waterways. The situation seems to merit at least the fullest investigation.

226. She has, entirely within her borders, and subject, therefore, to no interstate complications in the matter of control, two fine rivers, the Sacramento and the San Joaquin, which must necessarily serve as the arteries of any inland waterway system. The first of these furnishes at present all-year navigation for light craft boat up to Chico Landing, 263 miles from the sea, and for heavier draft boats to Sacramento; the latter has a 9-foot channel all the year round up to Stockton, 105 miles from the sea.

227. These rivers, for the distances indicated, would be permanently safeguarded for navigation by completion of the Sacramento flood control project now under way. In the event of further withdrawal of water from the stream for purposes of irrigation, as discussed in Chapter XI, "Relation between Navigation and Irrigation" (Secs. 254, 255), such withdrawal would not endanger navigation up to Sacramento City on one river, or up to Stockton on the other. Canalization could care for the upper portions of the streams, and could be so extended as to cover the balance of the two valleys—assuming that the expense of such canalization would be justified by the results, immediate or prospective.

228. On the floor of the two valleys drained by these two rivers lies an empire of upwards of 10,000,000 acres, capable under intensive cultivation of producing enormous crops of high value. Cheap water transportation to tide water would be a stimulus to the rapid development of these valleys. Intensive cultivation of all this territory would mean a rapid and wonderful growth in the population, wealth and commerce of the state, and without it the progress of the state must be necessarily retarded. (Sec. 372.)

229. With the ship canal from Sacramento City to tide water, suggested by the State Engineering Department, which can be constructed

apparently at a comparatively insignificant figure, there could be established, 122 miles from the sea, munition factories, docks and shipyards, with ready access thereto by the largest warship. (Sec. 374.)

230. Stockton, it is understood, could be similarly connected with tide water by ship canal, though the difficulties and expense would be greater because of the necessity of crossing certain silt-bearing streams.

231. San Jose could be made a deep water port by a canal from San Francisco Bay, and the products of the Santa Clara Valley loaded direct into the hold of ocean going steamers.

232. Investigation by the State Engineering Department shows that 200 second feet of water can be secured by proper drainage of water-logged lands in the San Joaquin Valley, and that this amount of water would operate a system of lock canals for the valley.

233. It is not sufficient, however, to have inland waterways in order to insure such prompt and economic movement of crops and material as will secure the greatest advantage and the greatest development. There must be provided at proper points along such waterways, the necessary docks and warehouses, and facilities for rapidly and cheaply loading and unloading. It is only in this way that the full economic value of inland waterways can be secured. The methods still followed along the California waterways are largely those of pioneer days, entirely at variance with modern labor-saving methods and necessarily adding greatly to the cost per ton of transportation. Germany, in providing for opening of canals and waterways, forces the cities which will be benefited thereby to provide proper harbors and the necessary facilities for loading and unloading which will secure most economic efficiency. California can well follow Germany's example in both matters.

234. If it is true that transportation by water can be rendered at much less cost than by rail, then railroads, even under the best railroad and interstate commissions, can not ensure railroad rates which will justify abandonment of waterways; for such commissions quite properly base the rates allowed on the cost of service to the operating company.

235. Just how far California will feel justified in expending moneys in improvement of inland waterways will depend partly upon the basis of comparison between rail rates and water rates. Rail rates necessarily include, in addition to profit, elements representing the original investment and the cost of maintenance and operation; water rates on open waterways include only allowance for depreciation and operation of craft (corresponding to rolling stock). On canals where tolls are charged, the toll becomes a part of the rate, but perhaps rarely represents a commensurate proportion of the canal's original cost and maintenance.

236. California therefore might determine that she would not embark upon a policy of providing extensive inland waterways unless it were

demonstrated that an allowance for the cost thereof, plus the charges for maintenance and operation, could be included in the rate charged for water freight, and still produce, for the commerce carried, a rate which would be lower per ton per mile than that charged for similar service on the competing railroads. Or, she might determine that her policy in waterways would be similar to that which she follows for wagon roads; she would provide open water highways and maintain them, and permit the public to utilize them in their own craft, for their pleasure and their business, and in competition with existing railroads. Good wagon roads are enabling motor trucks and jitneys to compete with railroads, in certain localities, in transportation of both passengers and freight. That condition is not likely to disappear. Open waterways maintained by the state would offer similar advantages to the public in the use of water craft; but they would ultimately increase the business of the railroads by providing cheap transportation for raw material and food products, thereby encouraging factories and building up communities whose transportation for business and pleasure would be supplied in greater part by the railroad. It is the latter policy of open water highways maintained by the state which the conference recommends, if it be found economically practicable.

237. If then a further development of inland waterways would aid in opening up for California products, world markets not otherwise available, and such development can be accomplished at a cost justified by the result, it would be a short-sighted state policy that would not develop the waterways. In the absence of the necessary exact data the conference can not make a more definite recommendation; but the possibilities justify its suggestion that the facts covered in the Appendix "A" hereto be carefully considered as foundation for an exhaustive inquiry into the subject which should include necessary surveys and estimates to determine the feasibility and cost of canalization of the two great valleys.

238. The value of an adequate inland waterways system to the state can best be determined by careful consideration of the principles indicated in this chapter and in Appendix "A"; by reference to the experience of other countries and other states; by study of the state's present waterways and the possibilities in the way of development, and the cost thereof; and by knowledge of the territory which could be served by waterway extension and the development possible in such territory under intensive cultivation and with certainty of access to profitable markets. The conference believes that California should ascertain without delay the cost involved in developing inland navigation along lines suggested, and then fix a definite policy in regard thereto, looking to securing as much advantage for her existing and possible waterways as is economically justified.

CHAPTER XI.

Relation Between Navigation and Irrigation.

239. The interests of navigation and of irrigation become antagonistic when irrigation, in order to grow crops, must take its supply from a navigable waterway, the navigation of which will be impaired thereby. In view of certain considerations of state interest set forth in Chapter X, on "Inland Waterways" (Sec. 221), it would be most unfortunate should conditions force a policy resulting in permanent impairment of the navigability of California's two great rivers. At the same time there has gradually grown up a well-defined public sentiment to the effect that irrigation is a higher use of water than navigation and should have preference where the two clash. This is on the theory that navigation has little value if there are no crops to move, while irrigation is conceded to be necessary in many places to grow the crop, and in most to insure its best development. There is the further consideration that in a channel like that of the Sacramento River, with capacity to carry much flood water, it becomes necessary at low stages, in preservation of navigation, to use many times the quantity of water which would be sufficient to float the commerce if confined in a smaller channel; and this excess, all of which could be utilized for irrigation, is wasted in flow to the sea.

240. In passing upon this problem the conference has unanimously declared it to be its judgment that where the interests of irrigation and inland navigation can not be harmonized, irrigation should have preference; but if it should appear necessary to take out of a navigable stream so much of its flow as to endanger navigation, then if such navigation be necessary in the state interest for insuring profitable markets for the products of irrigation, navigation should be maintained by canalization. For the purpose of relieving, so far as possible, the demands of irrigation upon navigable waterways, as well as for other reasons, the conference strongly urges that where practical, flood control problems be solved by storage and that such storage, by cooperation with other interests, be turned to beneficial use.

241. The menace offered to navigation by the demands of irrigation in this state is much more imminent than is generally believed. In the San Joaquin Valley, where there is more land to irrigate and less supply of water than in the Sacramento Valley, diversion of water for irrigation from the tributaries of the San Joaquin River has practically put an end to navigation in that river above the city of Stockton, though the river is navigable at all seasons for light draft boats for 15 miles beyond that point, and at high stages for 40 miles farther

upstream. In 1911 the United States engineer office at San Francisco under direction of congress made an investigation of the upper San Joaquin and advised against any improvement thereof for these outlined reasons:

> (*a*) The flow of the river is insufficient to properly provide for the requirements of irrigation and navigation.
> (*b*) Under conditions obtaining in the valley greater benefit can be derived from the use of the water for irrigation than for navigation.
> (*c*) The navigation periods that might be secured by any form of improvement of this river would be too short to permit of the development of a volume of water traffic commensurate with the cost of the improvement.

These findings may or may not be modified after consideration of the report of surveys of the valley recently completed by state and national cooperation.

The Sacramento's Receding Navigation.

242. In the Sacramento Valley, notwithstanding the great quantities of water and the limited use thus far made thereof, it is gradually becoming apparent that the state must, in the course of some time, decide definitely and permanently between the interests of irrigation and channel navigation in the upper part of the valley.

243. So far as concerns navigation in the upper Sacramento the situation already has assumed a grave aspect. As explained in Chapter X, on "Inland Waterways," the river is no longer navigable for any considerable annual period even for light draft boats (drawing 18 inches) above Chico Landing, while between that point and Colusa regular navigation is limited to one or two trips per week.

244. There are certain portions of the upper Sacramento River in which navigation can be maintained with very much less water than in other sections. For instance, from the Tisdale Weir (about 43 miles above the mouth of the Feather) down past Knights Landing to the mouth of the Feather, the Sacramento is narrow and deep, untroubled by mining debris and with a channel capacity of only 25,000 second feet. Above Tisdale Weir and up to Colusa the channel is wider, with over double the capacity named, but of similar character. Below the mouth of the Feather, and down to Sacramento City, the stream, while its present capacity is three times that named, has been seriously injured by mining deposits, and is wide and shallow, requiring much greater quantity of water to maintain navigation.

245. The amount of flow necessary to be maintained in the upper Sacramento River for navigation has never been officially determined by the War Department, but, based upon the approved recommendations

of a 4-foot depth of channel from Sacramento City to Colusa and three feet above Colusa, the district engineer's office at San Francisco has estimated, in a general way, that the following amount of flow would be necessary in different sections of the river: From Sacramento to the mouth of the Feather, 5,000 second feet; thence to Colusa, 4,000 (5,400 would be better); thence to Chico Landing, 5,000 (6,000 would be better); thence to Red Bluff, 8,000.

246. The low water flow of the river has varied at Red Bluff from 3,980 second feet in 1903 to 4,605 feet in 1908, while below the mouth of the Feather it was 5,700 feet in 1913 and 6,300 in 1908. There is noted in comparison of the figures given the very narrow margin existing between the actual low water flow, and the flow required for navigation. This furnishes sufficient explanation of the difficulties already encountered in the navigation of the upper section of the river. It must be evident that future increased withdrawals for irrigation must further complicate the problem.

247. Withdrawal of water for any purpose from a navigable waterway is not permissible under the law save with consent of the War Department, which controls such waterways in the interests of navigation and commerce. Congress granted directly permission to the Sacramento Valley Irrigation Company to take out of the Sacramento River just above Hamilton City, Colusa County, and so long as the diversion shall not seriously injure the navigation of the river, not exceeding 900 second feet. This water is used through the West Side Canal for irrigation on the Kuhn project. The maximum used at this time under this permit is about 700 second feet. A permit granted by the War Department in December, 1912, to R. T. Stone, of Davis, California, for not to exceed 800 second feet to be taken out near Elkhorn Weir, twelve miles above Sacramento, was never used, and has been revoked. No other permits have been granted.

248. Surveys made in the middle of September, 1916, by the United States Geological Survey and the State Engineering Department jointly, showed, however, that between Sacramento City and Tehama (178 miles) there were sixty-nine plants diverting water from the river; that these plants were actually diverting at the time about 1,500 second feet, though their capacity was greater; and that, of the total diversion, only 482 second feet was being taken out under authority of the one permit granted by the War Department. It is assumed that the remaining 1,000 second feet is being used under sufferance of the department and with tacit recognition of the valuable use to which it is being put.

249. Of the 1,500 second feet diverted at the time of survey about 1,050 was being used continuously in 24-hour runs for 5½ months by ten plants, the least of which was using 32 second feet. The

remaining 450 feet were used by smaller plants irrigating two or three times a season and for perhaps a week at a time. Additional diversions which are contemplated for projects already inaugurated, or in prospect, amount to 2,000 second feet, which will reduce the present stream flow at low stage almost one-half, with resultant injurious effects on navigation.

This survey showed the following actual flow at the stations named: Hamilton City, 4,670 second feet; Butte City, 4,830; Colusa, 4,870; Knights Landing, 5,040. There was accession from surface streams only between Colusa and Knights Landing and this to the extent of 494 second feet; and as the diversion between Hamilton City and Knights Landing was about 820 second feet, the increased flow indicated a return seepage from underground water of almost 700 second feet. The flow measurement, allowing for diversion, showed that 550 second feet was returned by seepage to the river between Butte City and Colusa.

250. The War Department has announced no policy as concerns the inevitable clash between navigation and irrigation on this stream. Its failure to stop diversions which are now being made without permit, however, seems significant when coupled with its declared policy on the San Joaquin, and a circular letter of June 1, 1916, issued by Major L. H. Rand, U. S. A., for the United States Engineer's office at San Francisco, advising interested parties that his office had reported adversely to Washington on the matter of improving the Sacramento River for navigation between Chico Landing and Red Bluff (52 miles). The circular letter declares:

> "The principal grounds upon which the adverse conclusions are based are that the prospects for navigation do not justify the expense that will undoubtedly be incurred to give navigation conditions so much better than are now established that actual navigation would be resumed, and that to permit a reasonable resumption of such navigation would require a restriction upon existing and prospective diversions of water, which are more valuable for irrigation purposes, that would prevent a reasonable development of irrigation."

While the original report has not been made public, it is probable from the language of the circular letter that the San Francisco Engineer's office has suggested certain superior claims of irrigation over navigation and has based its recommendations on that policy.

251. Whether a similar policy will be followed as regards the section of river between Chico Landing and Colusa (51 miles), and afterwards as regards the stretch below Colusa, will apparently depend upon the

commerce handled upon those sections, or on a showing made as to the commerce which would be handled were certain improvements in navigability made. Some idea of the commerce of the Sacramento River and of the probability of its increase may be had by reference to the report of the Flood Control Committee of the House of Representatives, April, 1916, House Report No. 616, at pages 63, 64 and 65.

252. The policy of the Board of Engineers for Rivers and Harbors, and of the Rivers and Harbors Committee of congress, in the past, has been to base recommendations as to appropriations for improvement of navigation rather on the amount of commerce actually using the waterway, or on that which would immediately use it on improvement, rather than on that which might ultimately be developed if the waterway were improved. With so many demands upon congress in this matter it is not perhaps practicable to follow a more liberal policy—and the more liberal policy might open the door for economic waste in many localities.

253. The result has been, in instances, to permit gradual loss of navigability in streams which in time would offer most valuable transportation resources to the thickly populated district developed along them. It would be a short-sighted policy for California to permit navigability of the upper Sacramento or of any other navigable waterway to be permanently injured through neglect if it shall appear: (1) That such navigability may be maintained without detriment to the just demands of irrigation which may need the water of the channel for perfecting the crops; (2) that such navigability shall be necessary, or of great economic advantage, in the future for the moving of the increased crops of the district; (3) [if the two foregoing conditions are fulfilled] that the expense of maintaining such navigability shall not be greater than the expense of a canal system to afford the same service. It is interesting to note in this connection that on certain sections of the Rhine River a somewhat similar problem has been solved by erecting a rock barrier in the center of the stream and confining the flow at low stages of water to one side of the channel. The subject is one which merits the careful investigation of the state.

254. So far as concerns the Sacramento River channel from Sacramento City to its mouth, it can not be injured for navigation by withdrawal of any quantity of water from the river above, provided the channel of the river is cleared of debris and so maintained through flood control. The reason is that, with gradual elimination of debris deposits in the channel by current scouring and by control above, the lower section of the river will be kept in condition for navigation by

tidal influence. In pioneer days there was a tide of two feet at Sacramento City. Some years ago there was none at all. At present there is over a foot, and this condition will steadily improve with proper flood control.

255. A similar situation exists in the San Joaquin River up to Stockton, though the condition of the channel is much better at present than that of the Sacramento up to Sacramento City. The reasons are that Stockton is closer to the river mouth (45 miles as compared to 61) and that the San Joaquin River has not had to contend with large deposits of mining debris. Navigation in the upper San Joaquin has been for some years practically at an end, because the river's flow is withdrawn each year for irrigation; but navigation below Stockton has steadily improved.

A State Policy Necessary.

256. From the facts stated above it appears that the War Department is authorized, and perhaps directed, to prevent diversion of water from navigable streams if navigation shall be threatened by such diversion; that the time is near at hand when further diversions from the Sacramento River will interfere with navigation on the upper stream; that the department is tolerating, but has not sanctioned, certain withdrawals now being made; that it seems disposed to recognize the more valuable use of water for irrigation, but is perhaps prevented by law from sanctioning such use if it be apparent that navigation must suffer therefrom; and that the interests of the state lie in recognizing the superior uses of the stream for irrigation, and furnishing waterways, if necessary, by canalization.

257. It is manifestly necessary for the state to declare at once a broad and definite policy on the matter, and to secure from the federal government formal approval of such policy and effective cooperation in carrying it out. It is understood that the federal government has no proprietary rights in the waters of navigable streams and only such control of the use of such waters as may be necessary to protect navigation. Its permit to divert waters from a navigable stream is in effect, therefore, a certificate that such diversion may be made without injury to navigation. The permit does not and can not confer rights, which the government does not possess, to ownership of that water or to its use for purposes other than navigation. It is incumbent upon the state, then, to determine upon what conditions irrigators may divert water from the navigable streams of the state after the permit as now required has been secured from the War Department; also to

determine whether further diversion shall be encouraged after navigation is threatened, when so indicated by the War Department; and if such diversion be necessary in the interests of irrigation, as recommended in this report, then to obtain the formal sanction of congress to a policy recognizing the superior claims of irrigation; and finally, if navigation be still necessary for marketing of the crops of irrigation, then to provide for navigation by canalization.

CHAPTER XII.

Storage for Flood Control.

258. The conference formally declared in March, 1916, that, as irrigation, navigation and water power development—three of the state's great interests—will be promoted by storage, the flood control problems of the state should be solved, where practical, by storage.

259. Every student of conservation appreciates the valuable services which may be obtained from the mountain streams, through storage, for hydroelectric energy and for irrigation. He deprecates the great economic waste which results when the streams are permitted to flow, unhindered or aided, to the sea, and particularly when the flow consists largely of flood water, a source of danger and damage to the fertile valley lands. In such cases the failure to utilize storage when it is practicable, and thus prevent such injury and at the same time secure beneficial use of the flood waters, is an economic crime. That statement needs no demonstration.

260. It has been thought by some people that it was a mistake to attempt to control the floods of streams like the Sacramento River in any other manner than by storage. The conference devoted some time to the study of this question and the conclusion was reached that storage as a complete flood control medium in this state is untested. It has not been shown that it would take care of the problem of flood control on our large rivers, such as the Sacramento and San Joaquin, but the conference is satisfied that far more should be planned and done in the way of storage of water for flood control than is at present in contemplation. All the flood waters of the state—probably even the greater part thereof—can not be stored under existing conditions. In some instances it may be physically impossible, in others practically impossible, and in others economically impracticable, but in some instances where it is now economically impracticable, a definite declared state policy, calculated to insure cooperation among the different interests which may be benefited by water storage would undoubtedly make a number of storage projects economically feasible and hasten their inauguration.

261. The propriety of the conclusions reached by the conference in this matter can be best appreciated by general consideration of reservoirs and their uses, and a study of the more important flood control problems of the state, and the relation of storage thereto.

262. In connection with this subject careful consideration must be given to the antagonistic interests of flood control, irrigation and hydroelectric power in connection with the storing of water and its use. A

reservoir for highest economic efficiency in flood control should be kept empty until actual flood; it would be filled then by the first flood, and gradually emptied after that flood had subsided, in order to give storage for another flood. That same reservoir, if used for power or irrigation would, on the contrary, be filled as soon as possible—before actual flood if conditions permitted—and kept full, lest there should not be subsequent flood to fill it. Such a reservoir so used could not be considered, therefore, as more than a partial factor in flood control.

263. As to the storing of water, the interests of irrigation and power are identical, since they aim to insure a full reservoir; but their use of the stored water is antagonistic to a certain extent, because of the difference in demand at different times of the day and different seasons of the year.

264. It is quite evident, therefore, that a reservoir held, in private ownership and under private control, for irrigation or power purposes, could be of material value for flood control only in exceptional localities or under exceptional conditions. Speaking generally, the same site could be utilized for flood control as well as for the other purposes named only by increasing the height of the dam, and having in effect two reservoirs, the top one for flood control to be filled and emptied with the coming and going of the flood, and the lower one to be filled as soon as possible and kept full as long as possible to supply water when needed. Such double construction adds materially to the cost, even if other conditions are favorable, and it must assume public control for proper use of the flood control portion of the reservoir.

265. A reservoir maintained primarily for flood control can not be of great value for power or irrigation unless it is of sufficient capacity to contain a large part of the flood waters that may come to it, or is assisted by other reservoirs on the same stream. It should be remembered in this connection that it is the peak of the flood that does the great damage and whatever tends to check a portion of any flood may prevent that peak. However, it is true that for full flood control the water in the reservoir must be more or less regulated and allowed to run away when the flood peak is past, if the reservoir is not large enough to hold whatever floods may come. There are instances, however, when it is far more economical to expend moneys to control the floods in the mountains by reservoir than to expend the same amount of money trying to retain the flood and its load of silt in bounds as it courses across the lower lands, drops its load of silt, fills channels and seeks new courses, carrying destruction as it goes. Such flood control reservoirs, though not giving fullest efficiency for irrigation or power, can be depended upon to a large extent, especially for irrigation.

266. In general terms, therefore, it may be said that in California flood control by storage must be governed for some time by economic conditions; and that where flood control, because of such conditions, must for the present be secured by other means, future development may in time justify the use of great reservoir sites for irrigation and power, or either, in which case a wise state policy may induce such cooperation of interests as to make the reservoirs of value in flood control, if only as additional factors of safety. It is always to be remembered that any reservoir can be of value in flood control only to the extent of the actual flood it holds back at the critical time.

Storage of the Sacramento Floods.

267. The most severe criticism as to waste of water resources has been made against the state project for flood control of the Sacramento River which plans to send the flood waters through by-passes to the sea, instead of storing them, although it is claimed that there exist in the mountains storage facilities ample to hold back these flood waters and turn them to beneficial use.

268. The following statement made by E. G. Hopson, of the United States Reclamation Service, (and confirmed by his testimony before the conference October 28, 1915, pages 285–288 of transcript), indicates the very positive conclusions reached by engineers in this regard:

> "As to the possibility of reservoirs holding back the floods of the Sacramento Valley, there have been some very definite statements. We have collected a mass of information. All the reservoir sites are known to us and have been surveyed. It is impossible to hold back the greater part of the Sacramento floods by use of reservoirs. There are only two effective reservoir sites that I know of—that at Iron Canyon and one on the Pit River, and these could care for only the peak of the floods. Reservoirs never could hold back the great mass of flood water, and on that we can not lay too much emphasis. I think there is more fallacy abroad on that point than on any other point having to do with water problems. We could use all the sites available for the storage of flood waters, and they would affect only to an insignificant extent the flood problems."

269. This conclusion as to the extent to which storage may be utilized for flood control of the Sacramento River is fully confirmed by the army engineers of the War Department, and by the State Engineering Department, and by private engineers who have made special study of the matter. Full explanation of the conditions which justify the conclusion will be found by reference to the report of the State Reclamation Board, 1916, in the chapter on "Storage and Flood Control," at page 23; to the supplemental report of the Flood Control

Committee of the House of Representatives on the Sacramento River, 1916, House Report No. 616, pages 67, 68 and 69; and to the report of the Board of Engineers for Rivers and Harbors and the California Debris Commission for 1910, House Document No. 81.

270. There is in the Sacramento River drainage area one reservoir site which could be utilized to undoubted advantage in flood control of the river—the Iron Canyon site just above Red Bluff, the use of which for irrigation purposes is contemplated by the United States Reclamation Service. Assuming that a reservoir be constructed there and that it be used for flood control purposes as well as for irrigation and power, it could, according to the plans and estimates, hold back as much as 175,000 second feet of the floods of the upper Sacramento passing Red Bluff. If so, according to the Reclamation Board Report, 1916, it would justify material modification and perhaps the entire elimination of by-passes in the Butte Basin, but it would not justify changes elsewhere. This matter is explained fully in the State Reclamation Board Report, 1916, page 25, and also in the Iron Canyon Report, 1915, and in an appendix thereto which gives correspondence between the State Reclamation Board and the United States Reclamation Service, between which offices there is apparently entire accord on this point. Within the past few days, in a hearing before the State Reclamation Board, landowners in the Butte Basin expressed themselves generally to the effect that they did not wish to wait for possible adoption of an Iron Canyon flood control project to secure protection for their lands.

271. An instance of the manner in which future storage for irrigation or power will fit in with the Sacramento by-pass system is afforded in the problem of Cache Creek. This stream, with a maximum flood of 30,000 second feet, deposits masses of silt in the Yolo By-pass. Having created the Knights Landing Ridge, the stream has moved south and is making there another ridge. A corporation proposes to utilize Clear Lake as a reservoir for power and irrigation and hold there a large portion of the floods which have heretofore made Cache Creek a destructive stream. If a similar enterprise were to hold back the floods of Indian Valley, which pass also into Cache Creek, the flood control problem of that stream would be solved, in large part, and its floods turned to beneficial use.

272. There has been strongly advocated, for conservation of the flood waters of the Sacramento River, the plan of a sidehill canal to carry such flood waters from the vicinity of Red Bluff along the western slope of the Sierra foothills to the extreme southern end of the San Joaquin Valley, distributing the water on the way to reservoirs for irrigation, or permitting it to percolate through the valley soil and raise the underground water table, whence it could be raised by pumping. That plan

was generally outlined to the Flood Control Committee of the House of Representatives at its hearing on the Sacramento River, April 5, 1916, by Hon. F. G. Newlands, United States senator from Nevada, and by George H. Maxwell, and appropriation urged for investigation. (See pages 43, and 51 to 59, of the printed report of such hearing.) The Flood Control Committee, in its report (April 29, 1916, House Report No. 616, pages 68 and 69), points out the obstacles in the way of carrying out such a plan, and declares it is "practically impossible and perhaps physically impossible as well."

273. A method of treatment for the Sacramento similar to that followed for the Nile has been suggested, to wit, spreading the floods over the arable lands and thus utilizing these floods for fertilizing purposes. The Colusa, Sutter, Yolo, American and Sacramento basins have been used by Nature in the past as detention reservoirs for floods of the Sacramento. Such use, however, did not prevent destructive floods. The floods, too, did not run off these basins in time to insure a safe crop, and now the large part of the acreage in these basins is reclaimed, or in process of reclamation. It should be remembered, too, that the floods coming from the Feather and American rivers carry large quantities of mining debris which destroys the land for agricultural uses, instead of fertilizing it.

274. It would seem, therefore, that storage for flood control of the Sacramento River as far as known now, can be of value only to a limited extent. It is declared by the various interests concerned in flood control of the river that they can not postpone completion of the complete plan now in progress for such doubtful benefit, but that the state plan has been so arranged that reservoirs constructed for any purpose can be made to fit into it and to afford additional factors of safety to the extent of the floods actually held back.

Storage of San Joaquin Floods.

275. The prospects for securing flood control of the San Joaquin River and its tributaries by storage are very much more promising than in the case of the Sacramento, and yet the engineers warn us not to be too sanguine that all the floods of the San Joaquin Valley can be so conserved. Until a comprehensive flood control plan for the San Joaquin Valley has been prepared, as elsewhere referred to in this report (Chapter V), a definite conclusion on this point can not be reached.

276. It is generally believed that the problem of the Calaveras River floods, which menace the city of Stockton, can be best solved by storage. At present the so-called "diverting canal" offers insufficient protection to the city and causes inundation of several thousand acres of farming lands. Stockton, at the legislative session of 1915, endeavored to have

this territory included in the Sacramento and San Joaquin Drainage District, under jurisdiction of the State Reclamation Board, that the problem might be properly handled by construction of a reservoir. The measure, however, did not pass. Three alternative plans are proposed. One of these, at an estimated expense of $650,000, would care for the two-day flood of 1911 (the largest on the Calaveras in recent years), and incidentally store 50,000 acre feet of water which could be used to increase low water flow of the San Joaquin or for irrigation or power. An expenditure of $1,500,000, with a dam 180 feet high, it is estimated, would give a reservoir capacity of 230,000 acre feet, 160,000 of which could be used for irrigation or power.

277. A project referred to as the Pine Flat project is now on foot for the construction of a large reservoir on the Kings River, designed to hold 600,000 acre feet of water at an estimated cost of $6,000,000. The waters thus stored, it is estimated, will irrigate 400,000 acres of land now arid, and provide improved irrigating facilities for 600,000 acres more. The floods of the Kings River flow partly into the Tulare Lake Basin and partly into the San Joaquin River. In the delta of the San Joaquin they have been made the subject of suit on the part of land owners who claim that waters which would naturally flow into Tulare Lake have been artificially diverted into the San Joaquin River. The Pine Flat project, if completed, would assist in solving this portion of the San Joaquin problem. It would also serve to relieve in large part the fertile basin of the Tulare Lake from inundation; and, taken in conjunction with the Tulare Lake reclamation project, would entirely solve the Tulare Lake problem. The latter project proposes to care for the floods of the Tule, Kaweah and Kern rivers, and when completed would permanently reclaim 200,000 acres of rich lake basin lands and provide water for the irrigation thereof. It has been represented to the conference that because of local conditions, these two projects can not be carried out save under state authority and under some such plan as is contemplated in the present Irrigation Commission Act.

Storage for the Los Angeles and Colorado.

278. In connection with the Los Angeles River flood control project, it can not be said, in advance of further reports by the Los Angeles County Board of Engineers for Flood Control, just what portion of the river floods can be stored for beneficial use. While the plan, elsewhere explained (Chapter V), contemplates wasting a certain portion in the sea, it is hoped that the greater portion can be either held in reservoir, or forced to an indirect beneficial use through the medium of check and saturation dams and gravel spreading beds, and diversion thereby into underground sources of supply.

279. Flood control of the Colorado River by storage is a problem in which physical difficulties are supplemented by interstate and international complications fully set forth in Chapter V of this report. The conference is not advised as to how far the floods of the Colorado could be controlled by utilization of reservoir sites in the upper reaches of the river and on its tributaries, nor as to the economical practicability of such a plan. It could not be followed, however, without concert of action on the part of the several states having interests in the stream, the United States, and possibly Mexico.

280. As to the value of storage in controlling floods in the lower reaches of the Colorado which threaten California lands, the following quotation from the conclusions of a progress report presented by the Special Committee on Floods and Flood Prevention of the American Society of Civil Engineers, January 19, 1916, has interest:

> *Reservoirs and detention basins.* At the head waters of streams, storage reservoirs and detention basins can be successfully employed to reduce flood height; which method is preferable, is dependent on local conditions. Their efficiency, however, rapidly diminishes as the distance from them increases.
>
> *Levees.* As you proceed downstream the influence of reservoirs on flood prevention rapidly diminishes and the influence of levees correspondingly increases in importance as a method of flood protection. On the lower alluvial reaches of long rivers, such as the Mississippi and Colorado, they afford the only sure means of flood control.

281. If it be physically practical to divert from the Colorado River and store in California sufficient waters for the purpose, several hundred thousand acres of land in the eastern portions of San Diego, San Bernardino and Riverside counties could be irrigated thereby; and there is no other available source of water supply for these lands. Such a plan could be made of value in partially controlling floods. But it is understood that Mexico sets up the claim that such a diversion, by diminishing flow in the river channel, might cause a change in that portion of the channel which serves as international boundary and thus violate the spirit of the treaty of 1884. The same contention is made as to diversion of the river's floods without Mexico's consent, and spreading them over lands for the fertilization thereof. It is evident, therefore, that, regardless of the feasibility of flood control of the Colorado through storage, California can not look to such methods for immediate protection of her rich valleys threatened yearly by the river's overflow.

Local Complications.

282. It should be said, too, that even the interests directly concerned in the conservation of water for irrigation are not always agreed as to the wisdom of storage as applied to certain local problems, even when such storage is practicable. This is noticeable where the ground waters, upon which irrigation may be dependent, are assumed to be fed partly by flood and stream flow, the storing of which might reduce such ground waters. For instance, the Alameda County Water District objects to the storage by the Spring Valley Water Company of the waters of Alameda Creek, and, under agreement of both parties, the State Water Commission will gather data during the next three years to ascertain just what effect such storage will have upon the ground waters upon which the water district is dependent for supply. The city of Santa Barbara was party to a similar suit as to its storage on the Santa Ynez River, but the case was recently compromised. These are instances of many existing cases in the state in which storage, whether attempted for irrigation or for other interest, is opposed by irrigation itself, because of the local complications. Such cases should be decided upon individual merit, and it would appear that authority for the purpose should be reposed in a state board or commission, as recommended in this report.

283. While the conference very strongly urges the use of storage for flood control whenever and wherever such plan is feasible even in part, it is forced, in view of the facts before it, to recognize the difficulties that exist in the adoption of a general policy of flood control by storage. The damage created by floods is too great to justify postponement of remedial measures until they can be based in all cases on a storage plan. They should be so based where practicable and if storage is not immediately practicable but is later possible, then the plans should contemplate utilization thereof as soon as feasible.

CHAPTER XIII.

Interstate Waters.

284. Conflicts have arisen and may arise between California and other states as to the control or use of interstate waters under the following conditions:

(*a*) In connection with the waters of a boundary stream such as the Colorado River.

(*b*) In connection with the waters of a living stream running from one state into another. There are instances of this phase of the question in the Truckee River, the only outlet of Lake Tahoe, which runs from California into Nevada, and in the Klamath River flowing from Oregon into California.

(*c*) In connection with the waters of an interstate lake. A notable instance is Lake Tahoe.

(*d*) In connection with the waters of a watershed which crosses the state boundary.

(*e*) In connection with artificial channels, canals or ditches which convey water from one state into another. In Lassen County is found an instance of (*d*) and (*e*) in the proposed project to utilize the waters tributary to Honey Lake Valley (some of which come from the Nevada watershed), by storing them on the Nevada side of the state line and carrying them over into California for use.

285. With regard to the complications which exist in connection with control and use of the waters of the Colorado River, the questions at issue can be finally determined only through an understanding between California and the several states interested in such waters, and also by a definite agreement between the United States and Mexico. Until these matters are determined the diversion and beneficial use of such waters, or even permanent measures for flood control, are beset with most serious difficulties. Active efforts should be made by California to secure early adjustment of these differences. (See Chapter V.)

The Lake Tahoe Controversy.

286. With regard to the waters of Lake Tahoe and the Truckee River, a serious question has arisen between power companies and the United States Reclamation Service, acting together on the one side, and the state of California and riparian landowners around the lake, on the other side. The United States Reclamation Service has sought for a number of years to utilize Lake Tahoe as a storage reservoir and to use its waters in the state of Nevada for irrigation in connection with the Truckee-Carson project. Power companies on the Truckee River in California have acquired certain rights, but the stream is not used for irrigation in this state, though it is used for such purpose in Nevada along the Truckee Meadows, and through diversion into the works of the Truckee-Carson project.

287. The Truckee River is the only outlet of Lake Tahoe, the rise in level of the lake being regulated by this outlet, and its fall being limited by a natural rim which guards the outlet. The Donner Boom and Lumber Company many years ago acquired a franchise from the state of California with power to erect a dam in the river and collect tolls for floating logs on its waters. The corporation died in 1906 through forfeiture of franchise. Its property was conveyed through other parties to the Truckee General Electric Company, which, in conjunction with the Reclamation Service, built a larger dam at the lake's outlet. Recently the Reclamation Service purchased, in a condemnation suit under stipulation, from the Truckee General Electric Company, its interest in the dam and land surrounding the outlet, and now claims, through such ownership, and as an appropriator of waters in the lake, the right to control and use the waters thereof, and incidentally to cut down the protective rim at the outlet which fixes the low water mark. It also claims that the dam, as government property, is free from control of the courts.

288. The landowners claim that through manipulation of the dam and change thereby secured in natural conditions, the lake has been so raised as to flood and seriously damage private property, and that the claimed right of the Reclamation Service to cut the rim and lower the low-water level would cause further damage to wharves and navigation. Some years ago $35,000 was collected from the Truckee General Electric Company for damages created by high water, and the landowners have now a suit against the Reclamation Service and the former owners of the dam, to prevent further manipulation of the lake's level and to secure damages for losses sustained.

289. The state of California, through its Attorney General, three years ago commenced a suit, which is still pending, to force the abandonment of the dam at the outlet of the lake so that there could no longer be, either by private parties or the Reclamation Service, artificial control of the lake's level to the injury of private rights and rights claimed by the state. The state claims that the dam is illegally maintained.

290. Aside from the state's interest in the control and use of the waters of the lake, it would seem undesirable to permit, if it can be avoided, such change in the lake's conditions as would injure or destroy the scenic beauties thereof. There seems to be involved also a serious question between the state and the federal government in the matter of control, a question upon which the state has not yet formally adopted a general policy. Such a policy should be declared and an early adjudication had upon the points involved in this matter. It is possible that an adjustment can be made under which the interests of water conservation can be economically served without injury to the lake's scenic beauties, and without injury to state or private rights, or if there be injury, then with due compensation therefor.

California Legislation.

291. It was because of the Lake Tahoe and Truckee River situation that the legislature of California in 1911 passed a joint resolution protesting against diversion from the lake as an invasion of the rights of the people, and reciting that the state claimed to own the major portions of the water. In the same year the legislature of Nevada adopted a resolution relating to the same matter, declaring that the diversion contemplated meets with the hearty approval of the citizens of Nevada, "notwithstanding the protest of the people of California whose claims to these waters we do not concede."

292. In 1911 California passed a law, approved March 3d, declaring it to be unlawful for any one to carry water from this state into another state through any means of conveyance, for use in such other state; and authorizing the Governor to prevent such diversion and to bring action through the Attorney General for such purpose.

293. In 1913 the California legislature added section 1410a to the Civil Code relating to rights upon interstate streams. The section reads as follows:

> "1410a. The entire flow of water in any natural stream which carries water from the state of California into any other state is subject to use in the state of California, under the laws of the state of California, and the right may be, so far as not already acquired by use in the state of California, acquired and held under the laws of the state of California. The rights to the use of such water held under the laws of the state of California, shall be prior and superior to any rights to the waters of such streams held under the laws of any other state."

294. It will be seen therefrom that the present policy of the state of California, as formally declared, so far as concerns the use in other states of waters having their origin in this state, is obstructive and prohibitive. The conference understands that California is within her legal rights in adopting the policy outlined. The conference believes, however, that it is a short-sighted policy which must necessarily result in reprisals from other states and that the better policy would be to permit to the citizens of other states diversion of the waters of streams of this state when such diversion does not conflict with the rights of this state or the citizens thereof, and provided such other states grant reciprocal rights.

295. Oregon, in 1911, enacted a statute of this nature which is still in force and which provides in effect that the state engineer may, at his discretion, decline to issue a permit for the diversion of water when the point of diversion is within the state of Oregon, but the place of beneficial use in some other state, unless, under the laws of such other state, water may be lawfully diverted within such state for beneficial use in Oregon.

296. The conference has had framed a bill in conformity with the recommendation herein made as to the future policy of California.

CHAPTER XIV.

Water for Mining.

297. From the fact that the mining interests of the state have made no representation to this conference suggesting the desirability of a change in the water laws so far as they affect that industry, it has been assumed that the existing laws are satisfactory to such interests.

298. The output of gold in California is about $23,000,000 annually and of copper about $5,000,000. In all methods of mining both minerals, water is used, and the mines must cease running when the water supply fails, or if the cost for water is excessive. Many mines are operated only for a few months each year because of inability to obtain water during the balance of the year.

299. Hydraulicking uses more water in proportion to the product secured than any other method of mining. Under national and state law hydraulic mining may not be so conducted in this state as to injure a navigable stream. Where its debris would find its way into the Sacramento or San Joaquin rivers, or the tributaries of either, it must operate under permit of the California Debris Commission (a federal body of army engineers) and provide reservoirs to hold back the tailings. This method is so expensive that very few mines can be operated under it, and those which are now doing so must eventually cease when their reservoir capacity is exhausted. There are now seven mines so operating under permit, three others have licenses at present suspended but which may be restored on completion of certain work; and five have been authorized to construct impounding barriers as a condition precedent to obtaining a license. The fifteen mines, if all working, will use approximately 18,000 miner's inches of water or 450 second feet. Practically all the water so used is afterwards available for irrigation.

300. On the Klamath and Trinity rivers, nonnavigable streams, and in the counties of Del Norte, Humboldt, Siskiyou and Trinity, there is unrestricted hydraulic mining.

301. The gold dredges use much water for flotation in their moving ponds, and are under federal and state supervision to the extent that they must so operate as not to discharge silt into the tributaries of the navigable streams to the injury of such streams. On the Yuba River, where definite plans have been formulated for the restraint of old mining debris, and where the United States has certain property interests in the dredging grounds, the dredges operate under a permit from the Secretary of War.

302. While hydraulic mining was stopped partly because of its injury to the rivers and partly because of its destruction of valuable farming lands owned by innocent parties, dredge mining is permitted so long as it does not injure the streams, because the land which it destroys is only that owned by the operating company. This destruction is occasioned by the fact that the dredge reverses the order of nature and, after digging to a depth of twenty to ninety feet, deposits the soil and sand at the bottom and the cobbles on top, in huge piles fifteen to twenty feet above the previous level of the ground.

303. Within the past few months, a dredge has been constructed by the Natomas Consolidated, and is operating near Folsom, which deposits cobble and soil in the order of nature. A second dredge working on the same principle, but with improvements, is in course of construction, and with it the soil will not only be deposited on top, but the ground will be left approximately at the level which existed before dredging. While these new dredges are a little more expensive in construction and operation than the old type, the Natomas Company intends hereafter to use them, and it is not improbable that other dredging companies could be induced to do so rather than face the steadily growing sentiment against destruction of the land.

304. Water is used for reduction of quartz by milling and the cyanide process, for placer mining, and for the flotation process, which in copper mining does away with smelting at the mine and the consequent destruction of surrounding vegetation.

305. It is probable that mining, with certain exceptions, will, when the question arises, be considered an inferior use for water as compared with irrigation and be compelled to yield to it if it interferes, as navigation evidently must. In most mining this interference does not exist because the water can be afterwards used for irrigation. The mining of such useful metals as might be necessary for the economic welfare of the state would not be called upon, perhaps, to yield precedence to irrigation. This might be true, at times, of copper, for instance. While it is probable that this problem will, to a considerable extent, work itself out, because the price which mining can pay for water service is as a rule much lower than that justified for irrigation, it still is desirable that the state in the near future should consider the terms of the problem and reach a conclusion thereon.

306. This conference recommends that the use of water in connection with mining be placed under jurisdiction of the State Water Commission.

CHAPTER XV.

Water for Municipal Purposes.

307. Fundamentally the use of water for domestic purposes is superior to any other use. Practically the fact that the amount of water required for domestic purposes, relatively speaking, is limited, and that the expense which such use of water can bear is large, to a very considerable extent removes the necessity of any conflict with other uses.

308. In view of the limited water supply of the state, the recognition of these facts is important as affording a reasonable basis for the belief that, subject to reasonable limitation, water for domestic purposes should be taken from localities where such diversion does not conflict with other uses.

309. Following this idea, the conference believes that the doctrine of "progressive development," under which a municipality can appropriate water in unlimited quantities to meet the anticipated needs of a remote future, is unwise. It unnecessarily ties up the water supply of the state and it interferes with and embarrasses all attempts at the full and prompt development of our water resources.

310. The conference believes that the State Water Commission should have sufficient discretion to make reasonable provision for future development and the anticipated needs of a growing city, but that, as a matter of right, a city should not be permitted, as it is now permitted by existing law, to tie up indefinitely the use of the water of our streams. Apparently, at the present time, by making an application for the right to divert water from any stream, a city can acquire the right, at any time thereafter, and in spite of any use that has been made of the waters of the stream in the mean time, or of any development that has taken place, when the need arises, complete its diversion and deprive the intermediate claimants of the right which they have acquired to use the water, and thereby destroy the improvements that they have made. It is, of course, plain that such right would absolutely prevent the expenditure of any money in utilizing the water which might ultimately be required by such municipality, and thus compel this very valuable resources to go unused indefinitely.

CHAPTER XVI.

Expense and Delay in Water Litigation.

311. The attention of the conference has been called to the great loss of time, energy and money which is occasioned by the present procedure in water litigation in this state, and after careful consideration it recommends the following methods as being calculated to materially improve the existing conditions in that regard.

312. (*a*) It believes that the findings of the three permanent commissions here recommended, to wit: the State Flood Control Board, the State Water Commission and the State Irrigation Board, should be conclusive as to matters of fact within their respective jurisdictions, and that the courts should be required to pass only upon legal points involved in water litigation. The benefits to be secured from this plan are twofold. It will secure, first, the adjudication as to the facts by a permanent board of expert specialists remote from local influence or prejudice and making continuous study of the points involved and with all resources at their command for intelligent and unprejudiced investigation. It will avoid, next, the great expense involved in trying issues of fact before lower courts in a number of counties.

313. (*b*) Much of the expense involved in water litigation is due to the present procedure of allowing testimony of expert witnesses on both sides of the case, with result that these experts are paid, not as independent investigators, but as biased partisans of one side or the other, offering only such testimony as will be of service to those who retain them. In some cases the greatest element of expense is the amount paid to engineers and experts for services and expenses. The conference recommends that this procedure in water litigation be entirely abandoned, that expert witnesses be not permitted to testify as such in behalf of either side, and that, instead, wherever necessary, an expert shall be selected by agreement between the parties to the suit, and in the event of their failure to agree, then such expert shall be appointed by the court. Such expert shall represent the court, shall investigate the points at issue and report thereon, and each side shall be at liberty to cross-examine such expert as to the facts concerning which he testifies. Bills looking towards this proposed change were before the legislatures of 1913 and 1915, but failed in one case of passage, and in the other of approval.

314. (*c*) We recommend that a certain procedure adopted by the legislature in 1915 with regard to litigation in reclamation cases, and already favorably passed upon by the State Supreme Court, be made applicable to all cases having to do with the control, use or ownership

of water in this state. The action referred to is indicated in an amendment to section 170 of the Code of Civil Procedure by the addition of subdivision 5 to such section. The section as thus amended provides that any superior judge in any case involving reclamation, levee, or drainage interests shall be automatically disqualified on the application of either party to the suit, and that the Governor of the state shall thereupon name a judge to sit in the case in the place of the local judge thus disqualified. It is the intent under this amended section to have the Governor name, if practicable, a judge so located as to environment as to be removed from all prejudice or probable influence in reclamation matters, and to have him try all the important reclamation suits. The result would be a great saving in the number of suits and the expense involved, since instead of trying in a number of different counties the same issue and receiving from the lower court decisions more or less different in character, the issue involved would be settled, so far as the lower court is concerned, by the decision of this one judge; and on appeal to the Supreme Court, if necessary the decision would become final.

315. The application of this principle to all water litigation would make unnecessary the trial of many cases, which, under the existing conditions, must pass through the lower courts of their respective counties; and the trial of other cases would be materially shortened because points involved and already decided by the court in other suits would be passed upon without testimony or argument.

316. (*d*) The present procedure in this state in connection with exercise of the right of eminent domain often permits dangerous delay and unnecessary expense in the completion of projects involving state interest and public safety. Local prejudices are apt to lose sight of public benefits, and awards in condemnation cases are not infrequently prompted by such prejudice rather than based on actual value of the property. The conference suggests a change in the procedure so as to conform more nearly to that now followed in Arkansas and Mississippi, and has prepared a constitutional amendment calculated to secure such change. It is proposed to make it possible for a state agency to take possession of property needed for a public purpose immediately on paying into court the estimated value of such property as fixed by the court. Thereafter proceedings are had by the court, and the value of the property determined after hearing of the parties thereto and investigation by experts named by the court itself. Based upon such award a final settlement is had, the plaintiff paying more into court or receiving a rebate of the amount already deposited, as the case may be. A similar plan was found necessary along the Mississippi River to permit prompt action in protection against floods, and it is desirable

for that and other reasons in California. The plan has the merit of preventing delay and conserving justice, and has been working satisfactorily in Arkansas and Mississippi for a number of years.

317. *Conflict between Civil Code and Act.* Prior to the enactment of the State Water Commission Act the provisions of law relative to the appropriation and use of water were found in Title VIII of the Civil Code. So far perhaps as the provisions in that title declared the substantive law relative to the right to acquire water, it was not in conflict with the provisions of the Water Commission Act, but so far as it provides method of procedure, there is a conflict, and the commission has recommended the repeal of all of those sections of the Civil Code relative to water and water rights which are in conflict with the provisions of the State Water Commission Act. This repeal is in the interest of simplicity and order, and also eliminates the danger of increasing complication and conflict arising from attempted amendment at various sessions of the legislature of such provisions of the Civil Code without a careful investigation as to whether or not such provisions or such amendment conflict with the Water Commission Act.

CHAPTER XVII.

State Aid in Interest of Conservation.

318. The state of California is now providing, under established policies and in various ways, for assisting in certain conservation work in the prosecution of which she has a direct interest; but there is an element in many, if not in most, conservation projects having to do with the control and use of water that justifies state encouragement. Big irrigation, reclamation and flood control projects, even big power projects, are conserving great natural resources of the state and, in the conservation thereof, adding to the wealth of the state and the prosperity and happiness of the people. Whether it be waste lands reclaimed and made to yield under intensive cultivation; or water used on thirsty land so that its productiveness is multiplied and the crops insured; or rich farming lands and populous cities saved from destructive floods; or unused water power harnessed and made to take the place of oil and coal—there is in each instance an economic benefit of great value secured by the state.

319. The facts outlined in this report clearly indicate the measure of the benefit to be secured by early utilization of these resources, and the corresponding loss which will ensue while the state fails or neglects to utilize them. Therefore the conference urgently recommends the immediate adoption of a state policy which, while carefully conserving the interests of state and people, will encourage and assist the early development of projects for the conservation and use of the water resources of the state.

320. First there should be established, as elsewhere suggested, a definite state policy as to the control and use of these various resources so that permanent legislation may be based thereon and the active cooperation of citizens of the state secured in inaugurating projects which will turn them to valuable use.

321. In addition the conference urges, as a wise business policy, that the state extend material aid to deserving enterprises of the character indicated, by loaning the state credit, under conditions which will insure the state against loss, and under restrictions which will safeguard the public service and the public safety. The adoption of such a policy will necessitate the passage of a constitutional amendment permitting the use of the state's credit in the manner suggested, and a measure of this character is submitted with other proposed legislation.

322. In the case of water power enterprises, it will perhaps serve if permits are granted sufficiently liberal in their nature to justify the investment of private capital with assurance that it will not suffer

confiscation or loss through subsequent state action; but also sufficiently restricted to prevent such enterprises securing ownership or improper control of natural resources, and to allow the state at any time to take over the property for a fair price, based on the actual amount invested and on physical valuation and disregarding good will and franchises.

323. In cases where storage is used for combined interests, including flood control and irrigation, in order to secure the economic and efficient use of the stream, it is frequently impractical for individual property owners to finance their portion of the cost. In cases of this nature where the economic benefits are unquestioned it would seem entirely proper for the state to loan its credit under proper restrictions and to be reimbursed in the future by the various districts or other interests benefited, in proportion to benefits received.

324. In flood control projects the damage averted, and in irrigation and reclamation projects the great resources conserved, add materially to the wealth and prosperity of the state and fully justify state encouragement.

There would seem, therefore, only the question of how the necessary state aid can be given with best results to the projects, without loss to the state and with least chance of injury to individuals. The conference favors a plan under which all projects seeking aid of this character shall have their plans approved, after careful investigation by a competent state authority, and shall have construction of works and operation thereof supervised by similar authority. Reasonable safeguards could be provided thereby to secure economic efficiency, safety to the public, good service at fair rates, and profit to stockholders, if there be any. The state should assure herself that the plan is feasible and economically practicable; that construction is properly done; that maintenance is provided for; and that the plant is operated without injury to other interests or to individuals.

325. So far as may be, the internal affairs of reclamation, irrigation and drainage districts should be left to the district organization under state laws aiming at efficient administration. It would seem wise, however, to confer power upon the proper state authority, on request of any district, to undertake construction of works of the district under plans approved by such authority. The policy recommended is practically that permitted to the State Highway Commission in the matter of building roads for a county, and in conformity with power now reposed in the State Reclamation Board in connection with the construction of separate units of the Sacramento flood control project.

326. As to financing: The bonds of the district issued under state supervision should be turned into the state treasury, and there should be issued in exchange therefor state bonds bearing interest at a rate per annum lower by 1 or 2 per cent than the project bonds. This

difference is intended to reimburse the state for expense incurred in behalf of the project. The state bonds would be marketed and furnish capital for prosecution of the project.

327. In case of irrigation and reclamation projects the project bonds should be payable in twenty (or preferably forty) annual installments, commencing after five or more years; and the interest prior to date of the first installment might be paid out of the bonds, if conditions justified such policy. Assessments for payment of principal and interest should be levied under state authority, and the assessments collected by the county tax collector the same as county taxes, and paid into the state treasury, thus automatically redeeming the district bonds and furnishing money for redemption of the state bonds. Tracts of land should be sold for nonpayment of assessment as they are sold for nonpayment of taxes. This method would insure to the districts full return for their bonds, whereas now they are sometimes sold at a discount of 15 to 30 per cent. It would also insure prompt payment of the bonds, while the state supervision would assist in securing economic administration of district affairs.

328. In the matter of assessment there exists a serious obstacle to adoption of a uniform plan because of the fact that irrigation assessments are levied ad valorem as are county tax assessments, while reclamation assessments are levied in proportion to benefits received by the respective parcels of land; and for assessment on such a basis county rolls furnish no data. This difficulty has been met by the suggestion offered, in Chapter IX—"Reclamation"—in connection with the Sacramento and San Joaquin Drainage District. Under the plan proposed the measure of benefit is fixed, after the completion of the project, by the difference between the assessed valuation of the land before commencement of the project and the assessed valuation after completion thereof, subject to certain modifications and equalization.

329. It is manifest, too, that the restriction, usual with irrigation districts, limiting the bond issue of the district to 60 per cent of the value of the land in the district plus the value of the works and water rights, can not be followed in reclamation districts, since usually in such districts the land prior to reclamation has only a nominal value because there can be no revenue from it, while reclamation will give it with certainty a high value. Reclamation bonds, however, can be made entirely safe under a policy which insures, through state supervision, adoption of a feasible plan of reclamation and prosecution of the work to completion.

330. Where irrigation and reclamation projects receive state aid under the plan suggested, it is the recommendation of the conference

that if practicable, individual landowners in the district be bound to offer for sale at a reasonable price for a continuous period, all holdings in the district in excess of 160 acres. It is usually only through subdivision of the land and the settlement thereon of families that the state will secure the full measure of return for the aid it extends.

331. The plan suggested above under which the state issues its own bonds in return for district bonds necessitates a constitutional amendment which can not be effective for at least two years, and possibly for four years. As a measure for temporary relief and in view of the importance of the matter, there is recommended, as a means of establishing the value of district bonds meanwhile, the following plan:

332. Create by legislative action a revolving fund of $500,000 and provide that, whenever a coupon upon any bond of an irrigation, drainage, flood control or reclamation district shall not be paid by the district, upon the presentation of such coupon to the State Controller, he shall pay the same out of such fund so long as any money remains in such fund. Such coupons shall only be payable when the bond shall have been approved by the proper commission, and such district shall have agreed to subject itself to the conditions herein specified. Whenever such payment shall not be returned to the state, with interest, within thirty days after demand by the state and shall amount to 15 per cent of the current interest due for any one year, the state, through such agency as may be designated, shall be given full administration of the affairs of such district until the repayment of such money.

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333. While, under the terms of the act which created it, the Water Problems Conference goes out of existence on November 30th, one month before convening of the legislature, which is to consider its recommendations, the conference has requested its chairman pro tem. and the members of its legislative committee to furnish to the state administration and the legislature such additional information in connection with the work of the conference as may be desired.

A copy of the report will be mailed to any address on request to the State Printer at Sacramento, California.

Respectfully submitted.

STATE WATER PROBLEMS CONFERENCE,
V. S. McClatchy, Chairman pro tem.

W. H. Killam, Secretary.

CHAPTER VIII.

MINORITY REPORTS.

1.—Roscoe J. Anderson.

334. The main report of the conference contains in chapter II the following language: "There is perhaps no single member whose original views on some of these subjects have not been modified or entirely altered by his studies in connection with the work of the conference."

335. I would like to add that I doubt if there is a single member who would not still further modify his views and who would not disagree to a considerable extent with the report herewith submitted if he had the necessary time to make a more thorough study of the questions considered by the conference. The members of the conference were all busy men of affairs and none of them were paid for attending to the work of the conference so that what they did had to be sandwiched in between their many other duties.

336. I feel that we have not made a sufficient study and investigation of the questions at issue for us to safely recommend such momentous changes. Many of the conclusions arrived at have my hearty approval but I can not endorse the formation of two new salaried state commissions dealing with the water question any more readily than I would endorse the division of the Railroad Commission into various parts whereby there would be a commission for passenger rates and another for freight rates and still another for gas companies and others for something else.

337. We have a State Water Commission that is doing excellent work considering its limited authority, and rather than form a new State Flood Control Board and a State Irrigation Board, I would think that the wise thing to do would be to enlarge the powers of the Water Commission, giving them the authority to establish departments as the occasions demand and giving them sufficient funds to carry out this work. In my opinion, the State Water Commission, together with the Department of Engineering, will be better able to handle these water problems than a larger number of commissions.

338. It will be better and more convenient by far for the people of the state to have only one Water Commission to deal with than to give them so many commissions, thereby increasing their expense in organizing and operating their districts.

339. A larger number of commissions makes confusion to the individual and to the communities, especially during the organization period

of new irrigation or other water districts. This confusion may, in some cases, be of sufficient influence as to retard important development. Even today, under present conditions, it is necessary for an irrigation district to deal with the Water Commission, the State Engineer, the Bond Commission, and perhaps the Reclamation Board and if he is a private appropriator, with the Railroad Commission. Add to these the federal agencies with which he has to deal and then add still further commissions, as proposed by the recommendations, it can be readily seen that the private water user, or the district, will be delayed in the prosecution of their plans, and delay is frequently costly, if not fatal.

340. Instead of recommending a further division of authority necessitating still more legal difficulties and more complicated procedure, I recommend the gathering together of all state authority of matters pertaining to the private or public use or control of water and placing it in the hands of a single Water Commission with ample resources to handle the problems confronting it, and I am sure that such action will look better "from the ground up," will be more convenient for the people at large, although it may not look so well "from the top down," or be as convenient for the officers in charge.

341. Furthermore, the conference has gone on record as theoretically favoring the "placing all matters having to do with the ownership, control and use of water in this state under one commission."

342. And then, on the argument that our problems are not yet solved, it recommends the formation of two new salaried state commissions, with the suggestion that when they have solved the problems, it will then be the time to consolidate. The time when the water problems of California will be solved will not be seen by any man now living and, indeed, it will not be seen for a long time thereafter.

343. Furthermore, the time for a consolidation and coordination of work is when the work is being done, or before too many departments are created, and are proceeding at cross purposes, or at least are duplicating, to some extent, work of other departments. The placing of new commissions on state pay, creates new and powerful forces that will tend to prevent, at any time in the future, the proper consolidation and coordination of the efforts towards handling the water problems of our state.

344. The conclusions reached under the following headings of chapter II have my approval: "To Lessen the Riparian Right Evil," "Superior Rights of Irrigation," "Underground Waters," "Water for

Fish Life," and the aim but not the details under the headings entitled, "Expense in Water Litigation," "State Aid for Conservation."

345. Because of the above opinions possessed by me, I am unable, therefore, to subscribe to the report of the State Water Problems Conference, although I am in hearty accord with many of the principles contained in that report, but wherever it has to deal with a multiplicity of water boards and commissions, I must vigorously dissent.

ROSCOE J. ANDERSON.

2.—F. E. WOODLEY.

346. I can not sign the majority report because it is to my mind too voluminous. It goes into matters and gives data that did not come before the conference. The report as a whole creates much unnecessary work for new state salaried commissions or boards, which it also recommends the creation of. Some of the chapters as written are persuasive arguments for state financial aid in solution of water problems, and though not in so many words, for the proposed $5,000,000 state assistance of the Sacramento reclamation project in cooperation with the federal government.

347. While I am, to some extent, in favor of proper state aid of meritorious projects beneficial to the general development of the state, I can not indorse the report of the conference along this line. Reclamation and flood control are problems of interest to local territory and drainage areas, and the solution of such problems should be worked out and paid for by the parties or districts interested. I do not believe in the development of large private interests at the expense of the state.

348. I am in favor of reclamation and flood control being done by districts comprising the drainage areas of streams as far as practicable, such districts to be administered by a local board under the supervision of some state authority, having power to accept or reject the district's plans, and to require said districts to so formulate their plans that they will not interfere one with the rights and needs of another; also to supervise the construction and maintenance of dams, levees, etc., to see that they are in no way inimical to public safety.

349. I maintain that the Sacramento reclamation project is local to its drainage area and should be administered by a local board under state supervision, paying its own expenses the same as every other local project. However, I do not desire to interfere with the workings of the present district or law. But I do most emphatically object to a reclamation board having in charge the administration of the Sacramento reclamation project, with salaries from the state or otherwise,

supervising other districts of the state. I claim that this would not be fair or just to the state or to the other districts. Such board, responsible for this great Sacramento project, could not but be prejudiced in its favor. The problems of other districts would be liable to have to meet the needs of this great project to some extent, and other districts would be supervised with a less degree of openness of conviction and understanding of their problems than if supervised by an authority not connected with the administration of any district affairs.

350. I am opposed to the creation of any more salaried state commissions, and would suggest consolidation of water problems as far as possible. I firmly believe that the work of the Irrigation Board should be put under the Water Commission and the supervision of flood control and reclamation districts put under a department of the State Engineer's office.

351. The chapters on Irrigation, Riparian Rights, Storage for Flood Control, Water for Mining, Interstate Waters and portions of the other chapters I am in favor of, and I regret exceedingly not being able to cooperate with the other members of the conference in the full report, but have the strong convictions as here presented, and would not be just to myself or those I represent if I did not make them known.

F. E. Woodley.

APPENDIX "A."

The Economic Value of Inland Waterways to California.

(Referred to in Chapter X of the Report.)

352. Inland waterways offer two great advantages for the development of a country:

> (*a*) They provide freight transportation at rates usually very much lower than those which are asked for transportation by rail, and sometimes only a fraction of such rail rates.
>
> (*b*) They offer a method of transportation which can not be monopolized or controlled by capital or by great interests, and which does not necessitate large investment in roadbed and rolling stock, or their equivalents. With an open waterway any one who can buy a small barge and a gasoline launch can declare his independence of railroads, whether their rates be exorbitant or only unavoidably higher than his business can afford.

353. In consequence, the mere presence of navigable waterways, even if they be not generally utilized, is a deterrent factor which can prevent the maintenance of unjust railroad rates, and insure the communities and the state, therefore, a great financial benefit.

354. The railroads of the United States collect each year from producer and consumer, in the shape of transportation charges, an amount greater by $150,000,000 than the entire expenditures made for all purposes by the national government, by the forty-eight states, and by every county and every incorporated town and city of over 2,500 population in those states. This is a tax on the people which manifests itself inevitably in the price of goods and the cost of living.

355. Any method that will reduce the railroad transportation rates will reduce this tax measurably. Adequate water transportation will accomplish the purpose, and at the same time, curious as it may sound, will increase the business of the railroads. The reason is that raw materials, which frequently can not stand the cost of rail transportation, can be moved by water at a lower rate. With raw material thus made available, manufacturing enterprises can be built up whose finished products must, to a great extent, be moved by rail to reach the consumer. Products of the soil which would not be grown if dependent for distribution on rail transportation, may often reach local and world markets by water at rates that offer profit. Inland water transportation, therefore, encourages intensive cultivation of the soil, the establishment of factories and the growth of communities, whose demands for living, for comfort and for pleasure furnish steadily increasing business for the railroads in freight and passenger transportation.

356. The argument most quoted against the development of inland waterways in the United States is that they are now unnecessary because railroad competition and the interstate and state railroad commissions force the railroads to charge only reasonable rates. Conceding that commissions and competition will ensure at all times and everywhere reasonable railroad rates, it must be remembered that such reasonable rates, as allowed by the railroad commissions, are always, and properly, based on the expense to the railroad company of rendering the service. This expense, even if no allowance be made for watered stock and construction under exorbitant contracts to favored individuals, is usually more or less in excess of the expense of similar transportation service by water.

357. It is evident, therefore, that the policy of forcing all freight to accept rail transportation (in a country where water transportation is practicable), either by abandoning navigable waterways or by failing to develop them, must inevitably result in a great economic waste; while the contrary policy would increase the prosperity of the country, and incidentally add materially to the business of the railroads.

What Waterways Have Done Elsewhere.

358. The American public generally is only beginning to grasp some of these facts and to realize the significance thereof; but the countries of Europe and individual districts of the United States have for a longer or shorter period understood the value of inland waterways and profited by the knowledge.

359. Pittsburg has fought for many years to secure and maintain a satisfactory degree of navigability from Pittsburg to Cairo (the junction of the Ohio and Mississippi rivers). Her success has enabled her to carry a ton of coal to the Gulf of Mexico, 2,028 miles, for eighty cents or four-tenths of a mill per ton per mile. The railroad freight rate in carload lots is $5.30 per ton. The railroad distance is 1,227 miles.

360. Before California developed her oil fields she was forced to import coal in large quantities for fuel. Much of it came from Rock Springs, Wyoming, distant from San Francisco 973 miles. The railroad freight rate is $5.15 per ton.

361. The state of New York is spending $125,000,000 in enlarging and improving the Erie Canal, notwithstanding her efficient systems of railroads and the fact that her canal will be closed by ice for some months each year.

362. Canals connect the Great Lakes and give direct water communication with the sea and with New York. In consequence freight can be carried from Buffalo to Duluth by water for less than four-tenths

of a mill per ton per mile, while the return rate on iron ore by boat is about twice as much—in each case only a fraction of the rate for rail service. Chicago owes much of her commercial greatness to her position on this inland waterways system. With the knowledge thus gained, she is planning to secure direct water transportation to the Gulf of Mexico by necessary improvement of the Chicago Drainage Canal, which connects with the Mississippi River through the Illinois River.

363. Congress has had under consideration for some time the project of a coastal canal extending from Boston along the Atlantic Ocean to Florida, and thence along the Gulf of Mexico to the Rio Grande River, giving connection on the way with practically every seaport. This canal is intended not only for commercial purposes, but for national defense in time of necessity. It is projected in four sections: the first extending from Boston to Beaufort, North Carolina; the second from Beaufort to Key West, Florida; the third across Florida, and the fourth from the St. George Sound, Florida, to the Rio Grande River on the Mexican border. The estimates of cost run from $125,000,000 to $185,000,000, based on different conditions.

364. Corporations have recently been organized to utilize the waters of the upper Mississippi for freight transportation, notwithstanding that a part of the haul must now be made by rail because of unsatisfactory conditions in certain sections of the river channel.

365. In Europe the commercial life and prosperity of Holland and Belgium depend to a great extent on their canal systems, while France and other countries have carefully developed their waterways with most satisfactory results. Manchester, England, was saved from commercial death by an expensive canal. The experience of Europe is rich with instances of the sort.

366. At the very time that the battle of Verdun was at its height, France held ceremonies commemorating the "holing" of a tunnel 4½ miles long and larger in cross section than any other tunnel in the world, part of a canal system connecting Arles on the Rhine with Marseilles. France has had to depend on her canals largely during the war and has modernized 6,000 canal boats for the purpose.

367. The most striking proof perhaps of the value of inland waterways is furnished by the record of Germany. It is evident that, with her magnificient system of government owned and operated railroads she would have no use for canals, if the stock argument as to the uselessness of canals where fair railroad rates can be assured had any force. And with her centralized power and authority, lending itself readily to intelligent and efficient administration, she would not waste money in waterways which would make no return for the investment. But the

fact is that, with an investment of $2,255,000,000 in her railroads, Prussia had expended, up to 1905, $125,000,000 in improving inland waterways and canalization; that in that year she appropriated $80,000,000 more for the purpose; that in 1907 she granted $55,000,000 for enlargement of the Kaiser Wilhelm Canal alone; and that continuously since then she has followed the policy thus indicated, though the details are not available for this report. And the amounts named, being what the Prussian Government appropriated, is only a part of the total expended, for Prussia is only a portion of the empire, while costs of construction and maintenance are shared by states, communities, corporations and individuals. Even now, in the midst of the greatest war the world has ever known, with her resources and energies presumably taxed in defense of national existence, Germany yet finds her waterways so important that she is spending millions of dollars in extending and developing the system. Her canals have proved invaluable in war and indispensable for commercial growth in peace. A number of her cities date their development from the year that navigable canals gave them connection with the sea, and the same is true for great agricultural districts in the hinterland. The history of the commercial growth of these German cities and districts is most convincing in this regard.

368. In California, right at the door of the state capitol, is offered striking evidence of the value of inland waterways, though the facts are known to but few, even among those who give intelligent consideration to state questions. Notwithstanding certain unfavorable conditions 90 per cent of all freight between San Francisco and Sacramento, and between San Francisco and Stockton, is carried by water, the average rate being 35 per cent less than by rail. Yet there are five different railroads between San Francisco and Sacramento more or less competitive, and all eager for business. (See report of Flood Control Committee, House of Representatives, 1916; H. R. No. 616, pages 64 and 65 and authorities quoted there.)

California's Present Waterways.

369. On the upper Sacramento from points as far north as Colusa (90 miles above Sacramento) freight is shipped by boat, absorbing cost of moving by motor truck from farms eight or ten miles on each side of the river, and delivered at tide water for 20 per cent less than railroad rates. It is natural that such points in the Sacramento Valley should secure a lower rate to San Francisco than points in the San Joaquin Valley, equidistant, which have no water communication.

370. The districts about the bay of San Francisco and those traversed by the navigable portions of the Sacramento and San Joaquin rivers are thus entirely independent of railroads so far as concerns their

interrelations. No railroad strike could embarass freight transportation between those districts. In fact it was demonstrated in the summer of 1916 that even a tie-up of the regular steamer service by strike could not seriously interfere with the moving of perishable river freight. For nearly five weeks in June and July, in the very heart of the fruit shipping season, the steamers of the river transportation companies were idle because of strike, yet the perishable fruit crop along the Sacramento and San Joaquin rivers was moved without difficulty to Sacramento where it was transshipped to car for the Eastern market. This was accomplished by means of a few gasoline launches and their tow barges. The amount of fruit thus handled reached as high as 22,000 fifty-pound packages in a day, over 500 tons, largely pears and plums. Two times, or ten times, the quantity could have been moved on the river without difficutly, notwithstanding the entire stoppage of the regular lines of transportation. In this one instance a very great financial loss was averted.

371. The towns of Napa and Petaluma have water communication with San Francisco by creek, river and bay waters, a distance of 50 and 34 miles, respectively. On Petaluma Creek the commerce in 1915 amounted to nearly 900,000 tons, largely sand and gravel. While the same rates are allowed by the Railroad Commission in this case for all-rail and for water, tramp schooners and boats carry for 25 per cent and 30 per cent less. Nearly all the freight goes by water. It should be remembered, too, that in these cases as well as in those of Sacramento and Stockton, rail rates would undoubtedly be very much higher than they are if there were no water competition.

Possible Future Development.

372. These districts of the Sacramento and San Joaquin rivers and those about the bay of San Francisco and its estuaries, are the only ones in the state at the present time which have a practicable waterways system and the conditions which permit its utilization. By channel improvement and canalization water communication could be established between the bay of San Francisco and all parts of the Sacramento and San Joaquin valleys; and similar advantages for transportation conferred in this way on the greater portion of the state's most productive lands. By thus making it possible for this great acreage to transfer its products from light draft craft to the holds of ocean going steamers at a low freight rate, there could be created a profitable world market for such products. Without such market it is evident that only such crops will be grown as can be profitably disposed of, and that the development of these great areas—and therefore of the state itself—must be materially retarded. In the absence of the necessary investigation it can not be said now what it would cost the state to provide and maintain waterways which would make possible the results referred to.

373. It has been suggested that so far as concerns the great interior valley of California (comprising the Sacramento and the San Joaquin), its crops under intensive cultivation would be so enormous as to raise the doubt whether they could be moved with sufficient promptness by any railroad facilities economically practicable. The rice crop alone of eight counties along the Sacramento River has increased from 6,000 sacks in 1911 to 2,500,000 sacks in 1916. It is expected to multiply several times in the next few years. Even this year's crop would fill 6,000 cars, and as the rice must be moved as soon as harvested to avoid injury from early rain, it is not unlikely that the time will come when it will be found difficult to secure sufficient cars to move the crop.

374. It is understood that the report of the State Engineering Department for 1916, not now available, will deal with the subject of a ship canal connecting Sacramento with the bay of San Francisco. The subject was comprehensively treated in an address made before the Sacramento Chamber of Commerce, February 24, 1916, by P. M. Norboe, assistant state engineer, a copy of which address will be found among the documents submitted with this report. It is proposed to utilize the trough of a natural basin east of and adjacent to the Sacramento River, where the surface of the ground is nowhere more than ten feet above sea level. By dredging in this trough from Sacramento City for 17 miles south, then canalizing Snodgrass and Georgiana sloughs (navigable waterways), a canal of comparatively small cost and only 35 miles long could be constructed, giving Sacramento City communication with the San Joaquin River, about 20 miles above Antioch. There is a depth of 31 feet or more in the San Joaquin from the outlet point of this proposed canal down to Antioch, but below that point, and particularly from Pittsburg Landing to Benicia, the channel would have to be improved to accommodate vessels drawing 20 feet or more. If it be not feasible to improve this portion of the present channel so as to accommodate ships of say 26 feet or 30 feet draft, then it is suggested that a by-pass channel be cut from the head of New York Channel to Bullshead Point, each terminus being in 40 feet of water.

375. The suggested plan shuts out the waters of the Sacramento River, so that there will be no difficulty with debris deposit, and the canal will be filled at all times by tidal influence, without locks. It is pointed out that it would be difficult to find anywhere conditions which permit of the construction of a canal of this length, and with its possibilities for commerce and other purposes, for the comparatively small amount which would complete the proposed Sacramento Ship Canal.

376. A valuable adjunct to the state's inland waterway system may be found in the borrow pits of the by-passes of the Sacramento River

flood control project. These have been so planned by the State Reclamation Board that, with certain improvements, including locks, they can be permanently maintained as navigable channels. This was done primarily for the passage of dredges, which will be constantly employed in the upkeep of levees, but there was also had in view the future possible demands of commerce in the moving of crops, etc. The legislature has given the board power to force the construction of draws in all railroads and highway trestles crossing such borrow pits. The east borrow pit of the Yolo by-pass, for instance, will give communication from tidewater at Cache Slough to the mouth of the Feather River, 40 miles by the by-pass, but over 65 miles by the river. Suitable draws have been provided for in trestles constructed over this borrow pit by the Oakland, Antioch and Eastern Railroad, by the Sacramento and Woodland Railroad, and by the State Highway Commission. The Southern Pacific trestle, constructed prior to the passage of the act, has no draw as yet.

377. The borrow pit of the Sutter by-pass, with locks, would permit the passage of craft from the junction of the Sacramento and Feather rivers entirely through the Sutter Basin to its northern end, and past the Marysville Buttes into Butte County. The Southern Pacific has a draw span in its trestle crossing this borrow pit.

378. A channel between District 1000 and 1001, on the east side of the Sacramento River below the mouth of the Feather, gives access to the drainage canal east of such districts which communicates at its lower end with the American River.

379. While the draws referred to, with the exception of the bascule planned for the State Highway causeway, are not of a type to permit of the passage of commerce craft, save with great and expensive delay, the conditions are such that the necessary type of draws can be installed whenever the expense thereof is justified. As at present planned, access to these borrow pits could be had only from the lower end of each by-pass, but, if justified, a lock around each weir would give access from the river at the upper end as well.

380. A further aid to the use of these borrow pits for navigation lies in the recent ruling of the War Department, made in June, 1916, to the effect that the department has the right to prevent the construction of barriers to navigation in artificial channels as well as in natural waterways, and will order removal of such obstructions on the proper showing by interested parties. The ruling follows recent court decisions, and is a reversal of the department's former policy.

APPENDIX "B."

Proposed Legislation Submitted for Consideration in Accordance with Recommendations of the Report.

381.

1. Bill to repeal sections 1411, and 1414 to 1422, inclusive, of the Civil Code.
2. Bill to repeal section 1410a of the Civil Code.
3. Bill to repeal an act approved March 3, 1911 (Statutes 1911, ch. 104, p. 271), prohibiting the diversion of water from this state for use in another state.
4. Bill to amend section 15 of the Water Commission Act permitting the diversion of water from this state for use in another state and granting reciprocal rights on interstate streams.
5. Bill providing for appropriation of underground water.
6. Constitutional amendment providing for state guaranty of bonds of irrigation, reclamation and drainage districts (section 31 of Article IV).
7. Constitutional amendment enabling legislature to lend money or credit of state in aid of construction of reservoirs along streams (section 31 of Article IV).
8. Bill creating revolving fund for purchase of overdue bonds of irrigation, reclamation and drainage districts (as temporary expedient).
9. Bill providing for construction of storage reservoirs by state.
10. Bill amending section 637 of the Penal Code relating to the protection of fish.
11. Bill relating to statute of limitations as it affects a riparian owner, shortening time to three months.
12. Bill combining in one action injunction and eminent domain.
13. Bill amending section 170 of the Code of Civil Procedure relating to disqualification of judicial officers.
14. Constitutional amendment *re* eminent domain in reclamation cases (section 14 of Article I).
15. Repeal of section 40 of Water Commission Act, and amendment of California Irrigation Board Act so as to transfer to the latter commission the power to gather hydrographic data.
16. Bill requiring State Engineering Department to investigate and report *re* storage sites, flood control and canalization.
17. Bill giving State Flood Control Board jurisdiction over all matters of flood control, reclamation and drainage, and supervision of dams and reservoirs so as to insure public safety.
18. Bill changing method of assessment for Sacramento and San Joaquin Drainage District.
19. Bill providing for expert witnesses appointed by the court in all actions affecting the ownership, control or use of water.

20. Bill amending Water Commission Act so as to give commission discretionary power to make reasonable provision for future development for municipal purposes.
21. Bill amending section 20 of Water Commission Act so as to enable state to take possession of private enterprises at any time.
22. General law providing for organization of reclamation districts—organization by special legislative act to be discontinued.
23. Bill adding new section to Civil Code, numbered 530*a*, providing that no injunction shall issue unless there is actual injury to a present use.
24. Bill extending functions of State Irrigation Board to include general supervision of irrigation districts, and granting salaries to members of the board.
25. Bill amending Reclamation Board Act in various particulars.

APPENDIX "C."

List of Reports, Documents and Correspondence Submitted with the Report.

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COMMITTEE REPORTS.

Transcript of Minutes.—Meetings of September 18, 1915; October 27, 28, 1915; November 29, 30, 1915; January 21, 22, 1916; March 23, 24, 1916; May 11, 1916; April 31, 1916; June 1, 1916; June 28, 29, 1916; November 3, 1916; November 15, 16, 1916.

DOCUMENTS.

(*a*) IRRIGATION, RIPARIAN RIGHTS, UNDERGROUND WATERS.

1. Suggested Program of Legislation Relative to California Ground Waters, Charles H. Lee, minutes October 27, 1915.
2. State Policy as to Irrigation, Frank Adams, minutes November 29, 1915.
3. Use of Water for Irrigation After Power Development, A. Griffin, minutes November 29, 1915.
4. Irrigation District Law, A. L. Cowell, June 15, 1916.
5. Draft of Proposed Amendment to Irrigation Act, by Chas. P. Eells.
6. Improving Credit of California Irrigation Districts, Edw. N. Pearson, May 5, 1916, April 24, 1916, April 25, 1916.
7. Riparian Rights, Robt. L. Hargrove, minutes October 27, 1915.
8. Questions Concerning Issuance and Sale of Irrigation and Reclamation District Bonds, Chas. P. Eells, minutes October 28, 1915.
9. Irrigation and Land Settlement, Elwood Mead, minutes November 29, 1915.
10. Purposes of Irrigation, D. C. McClellan, minutes November 30, 1915.
11. State Control of Irrigation Districts and Water Rates, R. W. Hawley, May 31, 1916.
12. Adjudicating Water Rights, Max Enderlein.
13. Irrigation and Floods, E. E. Keech.
14. Duty of Water, Frank Short.
15. Irrigation Laws, Frank Adams.
16. Riparian Rights, L. A. Nares.
17. Water Rights, etc., Engineer Teilman.
18. Assembly Bill No. 328, Hawson Irrigation Bill.
19. Irrigation District Legislation in Canada, H. W. Grunsky.
20. Duty of Water for Irrigation, Robert L. Hargrove.

(*b*) Flood Control, Storage, Reclamation.

1. H. R. 14777 to provide for control of the floods of the Mississippi River and Sacramento River.
2. Letter from Devlin & Devlin (suggestions *in re* bonds of reclamation districts).
3. Water Storage in California, Its Uses, Value and Regulation, W. A. Beard, minutes November 30, 1915.
4. Flood Control and Storage Resources, W. H. Jacobs, minutes October 28, 1915.
5. Control of Our Two Great Floods, H. M. Chittenden.
6. Report Reclamation Board of California, 1916.
7. Supplemental Report of Flood Control Committee on the Sacramento River, House Report No. 616.
8. Flood Control and Reclamation in California, V. S. McClatchy.
9. Hearings before Rivers and Harbors Committee, July 23, 24, 1915.
10. Flood Control, J. B. Lippincott.
11. Outline of Plans for Control of Floods, Mrs. H. W. R. Strong, April 18, 1916.
12. Storage, G. McM. Ross, November 23, 1915.
13. Hearings Before Flood Control Committee of the House of Representatives, April 5, 1916.
14. Flood Control of the Sacramento and San Joaquin River Systems, Document 71.
15. Reports Board of Engineers on Flood Control to Board of Supervisors of Los Angeles County, July 27, 1915.
16. Flood Control Projects, C. E. Grunsky, minutes October 27, 1915.
17. Discussion Sacramento River Flood Situation, A. E. Anderson, minutes October 27, 1915.
18. Flood Control and Other Matters, E. G. Hopson, minutes October 27, 1916.
19. Flood Control in Southern California, M. V. Hartranft, minutes October 27, 1915.
20. Flood Control, H. F. Jackson, minutes October 27, 1915.
21. Adaptability of Reservoirs for Flood Purposes and Necessity for State Control of Reservoirs, V. S. McClatchy, minutes October 28, 1915.
22. Flood Control and Storage Reservoirs, W. H. Jacobs, minutes October 28, 1915.
23. Observations and Experiences in San Fernando Valley, Myron Westover, minutes October 28, 1915.

(*c*) Water Power and Conservation.

1. Hydroelectric Development and Existing Laws, J. D. Galloway, minutes October 28, 1915.
2. Copy Senate Bill 3331, Adamson-Shields Bill, and Myers-Ferris Bill.
3. Water Power and Irrigation, H. F. Jackson, minutes October 28, 1915.
4. Conservation, Francis Cuttle, minutes October 27, 1915.

5. Necessity for Water Power Development, Henry J. Pierce.
6. Federal Water Power Legislation, Henry J. Pierce, May 24, 1916.
7. Bulletin National Conservation Association, June 30, 1916, on Water Power Bills.
8. A Study of the Water Power Problem, J. L. Rollins.
9. Facts About Water Power, Executive Committee of the Water Power Development Association.
10. Water Conservation, A. G. Wishon.

(*d*) INLAND WATERWAYS, NAVIGATION.

1. Relation of Improved Waterways to Foreign Trade, S. A. Thompson, January 29, 1916.
2. Waterways and Commerce, Hon. Wm. C. Redfield, December 8, 1915.
3. Distance by Water to Points on Sacramento River.
4. A Deep Water Ship Canal for Sacramento, Major P. N. Norboe, November 24, 1916.
5. Proceedings Commonwealth Club of San Francisco.
6. Reports of National Waterway Commission.
7. The Inland Waterways Association and Its Work, Isidor Jacobs, minutes November 30, 1915.
8. Navigation for the Great Valley of California, H. D. Foote.

(*e*) POLICY, LITIGATION, FINANCING, GENERAL.

1. Land Settlement Under State Control, F. E. Woodley, December 18, 1915.
2. Possible Revision of Water Laws, Samuel C. Weil.
3. The Departmental Plan in Public Works, C. E. Grunsky.
4. Discussion of paper of C. E. Grunsky, J. D. Galloway, minutes October 28, 1915.
5. Water Legislation for Municipalities, Albert Lee Stephens, minutes October 28, 1915.
6. General Observations as to State Policy, A. L. Cowell, minutes October 27, 1915.
7. Settlement of Water Suits in the Superior Courts, Max W. Enderlein, minutes October 27, 1915.
8. Comments on Water Commission Law, J. D. Galloway, minutes October 28, 1915.
9. Rational Use of Water, Thomas H. Means, minutes October 28, 1915.
10. Wise Water Conservation Legislation, Morris Knowles, minutes November 29, 1915.
11. Appropriation of Water in California, A. E. Chandler, minutes November 30, 1915.
12. Oregon Water Laws and Interstate Waters, John H. Lewis.
13. Suggestions for Points to Be Considered in Formulating a Unified State Policy, W. F. McClure.
14. Diversion or Use of Water in Another State, J. H. Lewis, October 4, 1915.

(f) MISCELLANEOUS DATA.

1. Letter from Wm. Shaughnessy, City Engineer of San Francisco, September 5, 1916.
2. Letter from W. F. McClure, State Engineer, October 30, 1915.
3. Extract Engineering News—Decision Supreme Court in Oregon Water Case, June 29, 1916.
4. List of California Statutes on Irrigation and Reclamation.
5. Interstate Water Rights, prepared by Legislative Counsel Bureau.
6. Diversion of Waters of the Colorado, as Affected by Mexican Treaties.
7. Laws and Regulations Regarding Use of Water in Pan-American Countries, Rome G. Brown, January 8, 1916.
8. Arid Lands and Government Cooperation, H. Clay Kellogg.

(g) MISCELLANEOUS CORRESPONDENCE AND TWO CABINETS.

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